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Vol. 4 No. 20
Oct. 30, 1950

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NUCLEAR SCIENCE ABSTRACTS

Vol. 4, No. 20

Table of Contents for October 30, 1950

Category	Abstract	Page
DOCUMENTS REFERENCE LIST		iii
GENERAL		863
Atomic Bombs and Warfare	5820	
Atomic Power	5821	
BIOLOGY AND MEDICINE		863
Radiation Effects	5822	
Radiation Hazards and Protection	5829	
Radiography	5839	
Radiotherapy	5840	
Toxicology Studies	5843	
Tracer Applications	5845	
CHEMISTRY		867
Analytical Procedures	5854	
Deuterium and Deuterium Compounds	5861	
Fluorine and Fluorocarbons	5864	
Laboratories and Equipment	5875	
Molecular Structure	5879	
Radiation Effects	5882	
Rare Earths and Rare Earth Compounds	5883	
Syntheses	5885	
Tracer Applications	5887	
Transuranic Elements and Compounds	5888	
ENGINEERING		873
Heat Transfer and Fluid Flow	5901	
Tracer Applications	5902	
Vacuum Systems	5905	
MINERALOGY, METALLURGY, AND CERAMICS		873
Ceramics and Refractories	5907	
Metals and Metallurgy	5908	
Minerals and Mineralogy	5916	
PHYSICS		875
Astrophysics	5920	
Cosmic Radiation and Mesons	5921	
Instruments	5935	
Isotopes	5940	
Isotopes Separation	5941	
Mass Spectrography	5943	
Measuring Instruments and Techniques	5944	
Meteorology	5957	
Neutrons	5959	
Nuclear Properties	5963	
Nuclear Transformation	5973	

TABLE OF CONTENTS FOR OCTOBER 30, 1950

Category	Abstract	Page
PHYSICS		
Particle Accelerators	5988	
Radiation Absorption and Scattering	5989	
Radioactivity	5993	
Theoretical Physics	6005	
Tracer Applications	6010	
AUTHOR INDEX		A
SUBJECT INDEX		C
NUCLIDE INDEX		L
FOREIGN GEOGRAPHIC INDEX		N
PUBLISHED DOCUMENTS INDEX		O
NNES ANNOUNCEMENTS		P

ERRATUM FOR NSA

In abstract 4-5360, Nuclear Science Abstracts 4, 805(1950) Sept. 30, the final period should be replaced by a comma and the sentence completed with ... under deliberately severe conditions, to determine an optimum dilution program.

DOCUMENTS REFERENCE LIST

Vol. 4, No. 20

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED DOCUMENTS

Document	Title, Author	Abstract
AECD-2865	Preparation of Ductile Vanadium by Calcium Reduction. R. K. McKechnie and A. U. Seybolt.	5908
AECD-2887	The Determination of Thorium in Low-Grade Ore. B. H. Dickson and D. Kaufman.	5854
AECD-2888	Biological Monitoring of the Laboratory Area by Analyses of Rodents and Other Forms of Wildlife. K. E. Herde.	5829
AECD-2890	Isolation of Microgram Quantities of Naturally-Occurring Plutonium and Examination of Its Isotopic Constitution. D. C. Peppard, M. H. Studier, M. V. Gergel, C. W. Mason, J. C. Sullivan, and J. F. Mech.	5888
AECD-2891	Chemical Properties of Californium. K. Street, Jr., S. G. Thompson, and G. T. Seaborg.	5889
AECD-2897	Heats of Reaction of Some Oxides of Americium and Praseodymium with Nitric Acid and an Estimate of the Potentials of the Am(III)-Am(IV) and Pr(III)-Pr(IV) Couples. L. Eyring, B. B. Cunningham, and H. R. Lohr.	5890
AECD-2898	The Pentavalent State of Americium. L. B. Werner and I. Perlman.	5891
AECD-2901	Medical and Health Physics Quarterly Report: January, February, and March, 1950. University of California Radiation Laboratory.	5845
AECD-2903	The Potential of the Pu(III)-Pu(IV) Couple; the Hydrolysis Constant of Pu(IV). S. W. Rabideau and J. F. Lemons.	5892
AECD-2904	Fast Neutron Data. H. Feshbach.	5859
AECD-2905	Demonstration of Antidotal Action of Polyphosphate in Metal Poisoning. E. A. Maynard, H. C. Hodge, and W. L. Downs.	5843
AECD-2906	Tolerable Concentration of Product in Drinking Water. H. M. Parker.	5830
AECD-2907	Tolerable Concentration of Radioiodine on Edible Plants. H. M. Parker.	5831
AECD-2909	Behavior of Stack Gases in Still Air. A. F. Rupp, S. E. Beall, and L. P. Bornwasser.	5957
AECD-2910	Magnetic Susceptibilities of Some Uranium and Plutonium Salts. N. Elliott and W. B. Lewis.	5893
AECD-2911	New Studies in the Isolation and Properties of Curium. W. W. T. Crane and I. Perlman.	5894
AECD-2912	The Preparation and Some Properties of Curium Metal. J. C. Wallmann, W. W. T. Crane, and B. B. Cunningham.	5895

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
AECD-2913	Some Observations and Comments on the Oxidation Potential of Berkelium III-IV Couple. M. E. Jones and B. B. Cunningham.	5896
AECD-2915	The Absorption Spectrum of Americium. B. J. Stover, J. G. Conway, and B. B. Cunningham.	5897
	U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED DOCUMENTS	
AECU-913	Report for the Period July 1, 1949-June 30, 1950. Duke University.	5846
AECU-922	A Battery Charger and Control Circuit for the Beckman Spectrophotometer. R. Wellnitz and A. R. Ronzio.	5875
AECU-924	The Auto-reduction of Am(VI) and Am(V) in Dilute Acid. L. B. Asprey and S. E. Stephanou.	5898
AECU-925	The Disproportionation of Americium(V). S. E. Stephanou, L. B. Asprey, and R. A. Penneman.	5899
AECU-926	The Relative Rates of Reaction of Hydrogen and Tritium Hydride with Chlorine. W. M. Jones.	5852
AECU-928	The Vapor Pressures of Hydrogen, Deuterium, and Tritium up to Three Atmospheres. E. R. Grilly.	5853
AECU-930	A Method for the Prevention of Leaching and Chemical Fogging in Nuclear-Track Autoradiographs, and the Maintenance of High Sensitivity and Latent-Image Stability. A. I. Williams.	5839
AECU-931	Micro Synthesis with Tracer Elements. XIV. The Preparation of 3,3'-Methylene-C^{14}-bis(4-Hydroxy Coumarin). A. Murray, C. W. Bills, and A. R. Ronzio.	5885
AERE-C/R-526	The Determination of Copper in Uranium Copper Alloys. M. Gibson.	5857
AERE-G/M-66	The Reaction $^{7}Li\ \gamma\ p\ ^{6}He$. E. W. Titterton.	5986
AERE-INF/Bib-61	Some Published Reports on the Effects of Radiation on Reproduction and on the Genetic Effects of Radiation. A. Lundie.	5826
AERE-INF-Bib-67	The Binding Energies of the Triton and the Alpha Particle. Atomic Energy Research Establishment.	5963
AERE-N/R-473	The Collimation of Nuclear Particles for Energy Measurements in Pulse Ionization Chambers and Proportional Counters. J. Howlett and W. J. Whitehouse.	5945
ANL-4443	Spectrophotometry of Neptunium in Perchloric Acid Solutions. R. K. Sjoblom and J. C. Hindman.	5900
ANL-4468	Photoneutron Thresholds of Beryllium and Deuterium. R. C. Mobley and R. A. Laubenstein.	5973
ANL-4473	Radiations from 120-Day Ta^{182}. D. W. Engelkemeir, M. S. Freedman and J. May.	5993
BNL-58	Conference on Waste Processing. Meeting of the United States Atomic Energy Commission Waste Processing Committee, March 27-28, 1950. Section I. Brookhaven National Laboratory Waste Problems. J. H. Hayner and B. Manowitz.	5832
BNL-64	Quarterly Progress Report: April 1 - June 30, 1950.	5918
HW-18321	A Rapid, Simple Method for the Determination of the Radon Content of Water. R. C. Thorburn and J. W. Healy.	5855

DOCUMENTS REFERENCE LIST

Document	Title Author	Abstract
KLX-1306	June Summary Progress Report on Gas Decontamination (24-A-2). Kellex Corporation.	6010
LA-901	Differential Cross Section of the Reaction $He^3(d,p)He^4$ at 10.2 Mev Bombarding Energy and Search for an Excited State of He^4. J. C. Allred.	5974
LA-1122	Rotating Mirror Camera Design. B. Brixner and A. J. Lipinski.	5935
M-4419	Manuals for Brookhaven National Laboratory. Book No. 6. Laboratories Manual (Design, Operation, Maintenance). H. K. Ferguson Co.	5876
NAA-SR-62	Thermodynamic Diagrams for Sodium. T. H. Inatomi and W. C. Parrish.	5901
NACA-TN-2162	Investigation of Properties of AISI Type 310B Alloy Sheet at High Temperatures. E. E. Reynolds, J. W. Freeman, and A. E. White.	5911
NEPA-1448	Matrix Solutions to Steady State Distribution of Particles of Bulk Matter. W. C. DeMarcus.	5989
NRL-3613	Penetration of Gamma Radiation Through Thick Targets. W. R. Faust.	5990
NYO-543	Progress Report for December 1949. C. G. Moore, D. S. McKinney and J. C. Warner.	5856
NYO-1524	Monthly Report on Laboratory Activities of the Health and Safety Division for April 1950. M. Eisenbud.	5833
NYO-1527	Final Progress Report: Harvard University. L. Silverman, G. S. Reichenbach, Jr., and P. Drinker.	5834
ORNL-617	Cation Exchange Between Cells and Plasma of Mammalian Blood. II. Sodium and Potassium Exchange in the Sheep, Dog, Cow, and Man, and the Effect of Varying the Plasma Potassium Concentration. C. W. Sheppard and W. R. Martin.	5847
ORNL-786	Health Physics Division Quarterly Progress Report for Period Ending July 15, 1950. K. Z. Morgan and F. Western.	5835
ORNL-811	Recent Evidence on the Mechanism of Chromosome Aberration Production by Ionizing Radiations. N. H. Giles, Jr.	5822
UCLA-81	The Effect of Roentgen Ray Irradiation on Normal, Hypothyroid, and Hyperthyroid Rats. T. J. Haley, S. Mann, and A. H. Dowdy.	5823
UCRL-689	The Heats of Formation of Sodium-Tin Alloys. R. L. McKisson, and L. A. Bromley.	5909
UCRL-739	Three New Delayed Alpha Emitters of Low Mass. L. W. Alvarez.	5994
UCRL-762	The Choice of the Proper Refractory for the Casting of High Melting Electropositive Metals. L. Brewer.	5907
UCRL-774	Production of Positive Mesons by Photons on Hydrogen. A. S. Bishop, J. Steinberger, and L. J. Cook.	5921
UCRL-804	Carrier-Free Radioisotopes from Cyclotron Targets. XI. Preparation and Isolation of Os^{189} and $Re^{183,184}$ from Tungsten. J. D. Gile, W. M. Garrison and J. G. Hamilton.	5975

GENERAL

5820 Engineers in Atomic Offense and Defense. David B. Parker. Military Engr. 42, 257-9(1950) July-Aug.

It is pointed out that engineers will be concerned with most phases of the military application of atomic energy. Tactical use of atomic bombs, radiological defense, protective construction, and water decontamination are discussed from the military point of view.

5821 The Chemical Engineer's Part in Developing Atomic Energy. Intern. Chem. Eng. & Process Inds. 31, 359-61(1950) Aug.

The report, based on observations of a technical press representative at the Atomic Energy Research Establishment, Harwell, England, briefly discusses metallurgy relating to uranium and plutonium production and reactors, solvent extraction, mineral dressing, the function of graphite in a pile, extraction of plutonium, and possibilities of nuclear power.

BIOLOGY AND MEDICINE

5822 Recent Evidence on the Mechanism of Chromosome Aberration Production by Ionizing Radiations. Norman H. Giles, Jr. ORNL-811, Aug. 29, 1950. 27p.

Recent experiments have demonstrated that oxygen has a marked effect in increasing the sensitivity of chromosomes in Tradescantia and other plants to x-rays, as measured by the frequency of cytologically detected aberrations. It has been shown that this is not an effect of oxygen itself on the behavior of broken ends of chromosomes. The effect apparently arises from the production by x-rays, as a result of the radiodecomposition of water in cells containing oxygen, of some substance which causes an increase in aberration frequency. Several independent lines of evidence indicate that this substance may be H_2O_2. It appears likely that the increased frequency of aberrations arises from an increased production of chromosome breaks when oxygen is present during irradiation, rather than from a modification of the recovery process. Thus a major fraction of the radiation effect on Tradescantia chromosomes is to be considered indirect rather than direct.

5823 The Effect of Roentgen Ray Irradiation on Normal, Hypothyroid, and Hyperthyroid Rats. Thomas J. Haley, Samuel Mann, and Andrew H. Dowdy. UCLA-81, July 10, 1950. 13p.

Thyroparathyroidectomy does not significantly increase the survival time nor decrease the total mortality of roentgen-ray irradiated rats. Hyperthyroidism produced by the subcutaneous injection of thyroxine or thyroglobulin into rats causes a significant increase in mortality rate as compared with normal and hypothyroid animals even though there are no significant differences in total mortality. Thyroxine and thyroglobulin premedication of hypothyroid rats decreases their survival time, as compared to nonmedicated hypothyroid and normal animals, but total mortality was practically unchanged. (auth)

5824 Attempt to Detect a Mammary Tumor-Agent in Strain C Mice by X-radiation. Howard B. Andervont and Thelma B. Dunn. J. Natl. Cancer Inst. 10, 1157-90(1950) Apr.

BIOLOGY AND MEDICINE

An experiment has been performed to ascertain whether low-mammary-tumor-strain C females harbored a weak or masked mammary-tumor agent. The C females were exposed to a single dose of 25, 50, 100, or 200 r of whole-body x-radiation and then bred to nonirradiated high-mammary-tumor-strain C_3H males. If irradiation enhanced the activity of the agent in C females, then the $C \times C_3H$ hybrids born to irradiated females should develop tumors at an earlier average age than those born to nonirradiated C females. The results confirmed the high incidence of mammary tumors in F_1 hybrids born to strain C females and strain C_3H males, but there was no significant differences between the tumor incidences or the average ages at which tumors arose in the hybrids born to irradiated and nonirradiated C mothers. (auth)

5825 Biological Effects of Radiation in the Karakul. Richard T. Street. Fur Farming J. 3, No. 5., 9(1950) Mar.-Apr.

A short note is addressed to fur breeders interested in the effects of radiation or ingestion of radioactive material on Karakul sheep. Nonquantitative methods of diagnosis and of treatment of radiation sickness with vitamin P are given. No experimental data are given, but the Karakul is stated to be one of the animals most resistant to radiation.

5826 Some Published Reports on the Effects of Radiation on Reproduction and on the Genetic Effects of Radiation. A. Lundie. Atomic Energy Research Establishment Report AERE-Inf/Bib. 61, Mar. 8, 1950. 10p.

5827 The Toxicity and Pathological Effects of Roentgen Rays in the Chicken. John A. Jacquez and David A. Karnofsky. Am. J. Roentgenol. Radium Therapy 64, 289-97(1950) Aug.

Acute deaths are produced by roentgen rays in young chicks at dose rates above 10 r/min and total doses of 1000 r or higher. The delayed LD_{50} dose, in those chicks surviving the acute effects of high dose rates, is about 800 r, and at low dose rates it is about 1100 to 1200 r. Adult chickens of both sexes may die acutely at total doses of 1250 to 3000 r, but they have often survived a dose of 5000 r for several days. Chickens surviving the acute effects succumb within 3 to 10 days, and the LD_{50} is in the range 600 to 800 r. The chickens dying acutely following irradiation show, within 2 hr after irradiation, necrotic foci in their livers, and pyknosis and fragmentation of their lymphatic cells. The delayed deaths are not associated with liver injury, but the lymphatic tissues, including the thymus and spleen, involute, the bone marrow becomes aplastic, erosions and degenerative changes occur in the intestinal tract, and there is frequent evidence of bacterial infections. These observations on the delayed effects of roentgen rays parallel those reported for mammals. (auth)

5828 The Toxicity of Roentgen Rays to the Chick Embryo. David A. Karnofsky, Priscilla A. Patterson, and Lois P. Ridgway. Am. J. Roentgenol. Radium Therapy 64, 280-8(1950) Aug.

Roentgen rays have been found to exert both an acute and a delayed toxic effect on the chick embryo. The acute effect results in death of the embryo within 20 hr after irradiation.

In embryos, 8 days and older, the acute toxic effect is dependent on a dose rate above 5 to 10 r/min, and is relatively independent of a total dose above 800 r. The embryo shows an increasing sensitivity to this acute effect during the 3rd to 7th day of incubation, it is most sensitive at the 8th to 10th day, and its response is stabilized at a slightly more resistant level on the 12th day and beyond. The acute death may be avoided, and delayed deaths produced, by lowering the dose rate appropriately for the age of the embryo at the time of irradiation. The delayed effects of roentgen rays are cumulative, and the LD_{50} for chick embryos of 2 to 12 days of age is in the range of 1000 to 1500 r, at dose rates varying from 1 to 43.4 r. The effects of roentgen rays are still cumulative to produce delayed deaths at a dose rate of 0.55 r/min. The embryos succumbing to the delayed lethal effect of roentgen rays may show vascular injury and hemorrhage, generalized edema, consisting of either a watery or gelatinous fluid, necrosis of the liver and stunting of growth. Developmental abnormalities are common, and are chiefly evident in the beak, limbs, head, and eyes. (auth)

5829 Biological Monitoring of the Laboratory Area by Analyses of Rodents and Other Forms of Wildlife. K. E. Herde. AECD-2888, May 26, 1947. Decl. July 12, 1950. 14p.

Wildlife (waterfowl, rodents, and carnivores) trapped near a radioactive-waste disposal pond or in a radiation laboratory have been examined for alpha- and beta-emitting elements. Tissue selectivity in radioactivity accumulation is shown and a condition of approximate equilibrium, with decay and excretion probably equal to absorption and accumulation, is suggested.

5830 Tolerable Concentration of Product in Drinking Water. H. M. Parker. AECD-2906, Aug. 4, 1945. Decl. June 28, 1950. 2p.

The permissible amount of plutonium deposited in bone is taken to be 0.5 μg. The absorption of plutonium from the gastrointestinal tract is of the order of 0.05%. From these data, the following temporary permissible concentrations of plutonium have been calculated: village water supply, 10^{-5} μg/cc; plant water if village water is pure, 5×10^{-5} μg/cc; plant water if village water is contaminated, 2×10^{-5} μg/cc. The possibility that absorption through minor cuts might set a lower tolerance limit is considered, and experiments on absorption of plutonium from dilute solutions by skin wounds is recommended.

5831 Tolerable Concentration of Radioiodine on Edible Plants. H. M. Parker. AECD-2907, Jan. 14, 1946. Decl. June 28, 1950. 5p.

The limiting hazard of radioiodine deposition on the ground may be either direct radiation from the contaminated surface or the ingestion of contaminated vegetation by men or animals. Studies on the uptake of I^{131} are reviewed and tolerance concentrations of I^{131} in vegation are set for men, horses, cattle, sheep, swine, and chickens. The values are well below those at which the external radiation hazard is significant. The tolerable concentrations in drinking water for farm animals is given, and proposals for further studies are made.

5832 Conference on Waste Processing. Meeting of U. S. Atomic Energy Commission Waste Processing Committee, March 27-28, 1950. Section I. Brookhaven National Laboratory Waste Problems. J. H. Hayner and B. Manowitz. BNL-58, nd. 27p.

A general discussion is given of the problems involved and the progress being made at Brookhaven National Laboratory on the geological survey of the area, the meteorological survey, monitoring of airborne, low-level, and liquid-waste activity, handling and treatment of liquid wastes, and the permanent disposal of radioactive wastes.

5833 Monthly Report of Laboratory Activities of the Health and Safety Division for April 1950. Merril Eisenbud. NYO-1524, nd. 13p.

Brief statements concerning the New York Operations Office Health and Safety Division laboratory activities for the month of April are presented. This covers the work of the Instruments Branch, Analytical Laboratory, and the laboratory activities of the Radiation Branch.

5834 Final Progress Report: Harvard University, AEC Contract No. AT-30-1-Gen-238. Leslie Silverman, Melvin W. First, G. S. Reichenbach, Jr., and Philip Drinker. NYO-1527, Feb. 1, 1950. 65p.

Results of basic laboratory research on methods of increasing particle size and aggregation by condensation from sprays or other suitable means are reported. Data and techniques used for a limited number of field studies of performances of various dust and fume collectors are included. 28 references.

5835 Health Physics Division Quarterly Progress Report for Period Ending July 15, 1950. K. Z. Morgan and F. Western. ORNL-786, Aug. 28, 1950. 22p.

Progress is reported on the following investigations and activities: instrumentation problems involved in monitoring a municipal water supply, permissible radioisotope concentrations, preliminary specifications for a continuous water monitor, water and liquid-waste decontamination processes, preparations for an ecological survey of the Oak Ridge disposal area, dispersal of stack gases, backscattering and absorption of beta particles, radiochemical analysis of P^{32} in body fluids, and instruments for airborne geological surveys. In connection with the last investigation, formulas are given for the attenuation with height of gamma rays from sources uniformly distributed in the ground.

5836 Atomic Energy and Insurance. S. C. Rothmann. Best's Fire and Casualty News 1950, 37-8, 80-8 July.

A few of the more important questions relating to atomic energy use which should now be commanding the attention of the casuality and liability insurer are considered.

5837 Fire-Fighting and Radioisotopes. Suggested Safety Rules. Chem. Trade J. 127, 331(1950) Aug. 11.

Rules are given for advance precautions, tactics, and personal security measures to be taken in fighting fires involving the possible presence of radioactive material. These rules have been selected from "Radiation Hazards of Radioactive Isotopes in Fire Emergencies; An Introductory Report," published and distributed by the International Association of Fire Chiefs, 22 E 38th St., New York 16, N. Y., from which fuller details may be obtained.

BIOLOGY AND MEDICINE

5838 Handling Radioactive Wastes in Sewers. John D. Parkhurst. Sewage Ind. Wastes 22, 1073-6 (1950) Aug.

Brief mention is made of the types of radiation and their hazards and the problem of disposition of the large quantities of radioactive wastes being produced. Dilution and dispersion (in air, water, etc) and control, as in confinement in concrete containers or burial at sea, are considered.

5839 A Method for the Prevention of Leaching and Chemical Fogging in Nuclear-track Autoradiographs, and the Maintenance of High Sensitivity and Latent-image Stability. Agnes I. Williams. AECU-930, nd. 41p.

For a true interpretation of the localization of radioactive isotopes in histological sections it is necessary to eliminate leaching during both tissue preparation and autoradiographic processing. Leaching during tissue fixation can be kept at a minimum by the use of freezing-dehydration techniques instead of the more conventional methods. Leaching during exposure may be minimized by the elimination of water or other liquid between the tissue and the emulsion. To replace the previous method of floating a tissue section onto a photographic emulsion with water, a new modification of the technique, called the "dry mounting method," has been devised. Detailed procedures are given for the application of this method to the radioautography of soft tissue, bone tissue, peripheral blood, and bone marrow.

5840 Dose Measurements on Contact-therapy Tubes. W. J. Oosterkamp. Acta Radiol. 33, 491-505(1950) June.

The various causes of errors in contact-therapy dosimetry are analyzed and methods for avoiding these errors are described. Extensive measurements have been carried out in regard to the absorption characteristics of the x-radiation in aluminium, the half-value layer for different added filters, the field distribution where the effect of a compensating filter is described, the determination of depth-dose data and of isodose curves in a water phantom, the influence of secondary radiation from the applicators, and the dose rate of the stray radiation around the tube caused by scattering from the patient. A dynamic electrometer was used and proved to be very useful for this kind of work. The results of the measurements are compared with those obtained by other investigators. (auth)

5841 Some Clinical Applications in Radium Therapy of a Probe-type Direct-reading Dosage-rate Meter. M. Leverman. Brit. J. Radiology 23, 430-6(1950) July.

An account is given of some of the uses to which the clinical dosage-rate meter described in Brit. J. Radiol. 23, 424-9(1950) has been put, with special reference to radium therapy, in particular the intracavitary treatment of carcinoma of the cervix uteri. (auth)

5842 The Treatment of Thyroid Carcinoma with Radioactive Iodine. Sigvard Kaae and Olaf Petersen. Acta Radiol. 33, 539-56(1950) June.

A case of thyrotoxic carcinoma of the thyroid gland, with remote metastases, was treated with I^{131} with a satisfactory result lasting 17 months. In another case of recurrence following operation for a thyroid carcinoma, the tumor had invaded the trachea. The basal metabolic rate was normal.

BIOLOGY AND MEDICINE

The malignant tissue in the trachea yielded completely to treatment with I^{131}. In addition to the inevitable myxedema, which was treated with thyroidin, the complications consisted of a depression of the hemopoietic activity of the bone marrow and of transient swelling of the submaxillary salivary glands (radioactive iodine is excreted in rather high concentration in the saliva). No conformity was found between the histological pattern and the uptake of radioactive iodine in the thyroid malignant tissue. Therefore, it could not be decided histologically which cases were likely to respond to treatment with radioactive iodine. Previous roentgen therapy did not prevent concentration, even of considerable amounts, of radioactive iodine in the tumor tissue. 46 references. (auth)

5843 Demonstration of Antidotal Action of Polyphosphate in Metal Poisoning. Elliott A. Maynard, Harold C. Hodge, and William L. Downs. AECD-2905, nd. Decl. Aug. 28, 1950. 2p.

Uranyl nitrate hexahydrate, when fed at a 2% dietary level, causes lethal kidney injury in male albino rats. Since polyphosphate forms a very stable complex with uranyl ion, and calcium polyphosphate is in part excreted in the urine, the use of this compound as an antidote for uranium poisoning has been investigated. The intraperitoneal administration of calcium polyphosphate to rats on the first day of a 2% $UO_2(NO_3)_2$ diet delayed death; treatment on each of the first 5 days greatly reduced mortalities even after 45 days on the diet.

5844 Beryllium Inhibition of Regeneration. II. Localization of the Beryllium Effect in Amputated Limbs of Larval Amblystoma. Charles Stead Thornton. J. Expt. Zool. 114, 305-33(1950) July. (See also NSA 4-3348.)

An analysis has been made of the manner in which beryllium nitrate inhibits limb regeneration in larval Amblystoma. Limbs immersed in beryllium nitrate (0.1999N for 2 min), washed in running water for 10 min, and then amputated at the upper arm level regenerated normally. Inhibition of regeneration was produced only when the beryllium solution was allowed to enter the limb through a break in the skin. Pretreatment of limb tissues with beryllium nitrate, by means of a break in the skin, did not impair the ability of the limb to regenerate on later amputation. Limb regeneration was inhibited only when beryllium was present in the limb tissues at the time of amputation. The beryllium reaction was localized at, or within 0.5 mm of, the wound surface. Clipping away 0.5 mm of the tip of the beryllium-inhibited limb stump stimulated normal regeneration. Beryllium treatment of the regeneration blastema did not prevent its further proliferation, but the continued presence of beryllium in the blastema did interfere with its differentiation. (auth)

5845 Medical and Health Physics Quarterly Report, January, February, and March, 1950. University of California Radiation Laboratory. AECD-2901, May 2, 1950. Decl. Aug. 23, 1950. 105p.

Metabolic Properties of Plutonium and Allied Materials. The localization of Ca^{45}, Sr^{90}, Pm^{147}, Am, and Pu in the skeletal tissue of rats has been investigated by radioautography of the costochondral junction. Photographs and radioautographs of histological sections through the junction are presented. The distribution of tracer Ca and Sr coincides

exactly with that of bone salt and of Ca deposited in cartilage. None of the other three elements examined were localized in this pattern. The evidence for Pm indicates that it is deposited both at calcified surfaces and in potentially osteogenetic tissues found free from any osseous component. It is also found in spotty deposits in the vascular or perivascular regions within bone. Americium is similar to Pm except for the absence of the spotty distribution. Plutonium is demonstrated only with difficulty in any cartilaginous tissue, whether perichondrium, noncalcified, or calcified cartilage. Nevertheless, the possibility of demonstrating it 1 hr after injection suggests that there is a transitory localization adjacent to calcium salts. Its main localization is limited to the bony part of the rib, where its clear occurrence on both aspects of the bone (inner and outer) and its presence in the periosteal extension beyond bone proper suggests that it localizes mainly in actively osteogenetic tissues.

Tracer Studies on the Metabolism of the Fission Products. The metabolic fate of Ta^{182} has been studied in rats following intravenous and intramuscular administration as a citrate complex and as uncomplexed Ta salts. The metabolism of inhaled Ta aerosols formed by burning Ta metal containing Ta^{182} in an electric arc is also reported. Studies have been carried out on the organic binding of astatine to the thyroglobulin protein by the thyroid of rats and on the red cell/plasma At-concentration ratio.

The Mechanism of Skeletal Deposition of Radioactive Strontium in Young, Adult, and Rachitic Rats. Young rachitic rats show the same rapid initial uptake of $Sr^{89,90}$ as do young normal animals, and the maximum uptake is as great, but this radiostrontium does not remain fixed in the skeleton and is lost rather rapidly. Less than ⅓ of the dose present at 1 hr remains at the end of 24 hr. The rapid initial uptake may be associated with the potential bone growth and large amount of osteoid matrix present in these animals. The failure of the radiostrontium to remain fixed in the skeleton may be a result of the low phosphate level and failure of actual new bone-salt deposition in the rachitic rats. The rapid removal of radiostrontium in these rachitic animals suggests the possibility of important decontamination of radiostrontium deposited in the skeleton if similar conditions can be reproduced in normal animals.

Role of Alkaline Phosphatase in Bone Metabolism; Inhibitory Effect of Phosphate in Vivo. The intraperitoneal injection of inorganic phosphate, even in low concentrations, into young rats lowers the blood phosphatase level.

Effect of Zirconium Citrate on the Distribution and Excretion of Nb^{95} in Rats. The value of massive doses of Zr citrate as a decontaminant for Nb^{95} is demonstrated. The initial rapid drop in blood Nb^{95} level and the high urinary excretion rate are maintained by the Zr citrate action.

Versene Acid as a Radioyttrium Decontaminant. Data on the effectiveness of Ca versenate (ethylenediaminotetracetate) in removing Yt already deposited in the body are presented, and the toxicity of versene acid and Ca versenate to rats is determined.

Astatine^{211} Studies. Effects on the Thyroid. Autopsies on rats following 1.2 μc to 157 μc doses of At^{211} show that At has a highly selective destructive affinity for thyroid gland tissues. Photomicrographs of the thyroid tissues are given. Hematological studies are also reported.

Radiochemistry. Improved methods are given for the production of mc amounts of At^{211} and for the recovery and analysis of At in tissues. The preparation of carrier-free $Re^{183,184}$ from Ta and from W, and carrier-free Os^{185} from W is reported.

The Metabolism of the Lipoproteins. Studies are being made on the metabolism of cholesterol and the serum lipoproteins in the rabbit. Preliminary results are reported on the incorporation of tritium-labeled water into tissue cholesterol and on the rate of cholesterol turnover. The lipoproteins found in the blood of labeled-cholesterol-fed rabbits have been segregated and the specific activities of the various fractions found to be comparable. Lipoproteins labeled by giving radioactive phosphate to rabbits are found to have varying specific activities. Disappearance rates of all lipoprotein fractions injected intravenously are comparable whether the recipient is normal, cholesterol-fed-hypercholesteromic, or atherosclerotic.

Blood Lipids and Human Atherosclerosis. The presence of a class of lipid and lipoprotein molecules in the serum of the human and the cholesterol-fed rabbit associated with atherosclerosis in both species has been demonstrated. These molecules do not represent any part of the acute alimentary lipemia. The presence of these cholesterol-bearing lipid and lipoprotein molecules cannot be predicted from the analytical total serum cholesterol level. Partial dietary restriction of fat and cholesterol in the human results in a gradual decrease in the serum level of such molecules over a period of weeks to months. These molecules are present with a much higher frequency and at higher concentrations in patients who have survived a myocardial infarction than in corresponding individuals without known vascular disease. The presence of these molecules with increased frequency in other diseases associated with excessive atherosclerosis (diabetes mellitus, the nephrotic syndrome, hypothyroidism, hypertension, and coronary insufficiency) supports the hypothesis of their association with atherosclerosis.

5846 Report for the Period July 1, 1949 - June 30, 1950. Duke University. AECU-913, nd. 7p.

Shell Formation in Mollusks and Barnacles as Studied by Radioisotopes. A radioautographic technique has been developed by which radioisotope concentrations on irregular surfaces such as shells and bones may be localized. By the use of this technique, and by direct measurement, the localization and rate of exchange of P^{32} and Ca^{45} between oyster shell and sea water at 10 and 38°C has been studied. As an approach to the study of the relation of the enzyme carbonic anhydrase to shell formation, the carbonic anhydrase content of mantle tissue has been studied in relation to growth in mollusks.

The Isolation and Membrane Permeability of the Liver Cell Nucleus. Isolated cell nuclei have been obtained in a condition resembling that within the living cell and have been studied as physiological entities. The investigations include the development of procedures and media for nuclear isolation in quantity, the microscopic appearance and properties of isolated nuclei both from the point of view of determining the physiological properties of the nucleus and of evaluating the adequacy of the isolation procedure, and the effects of heparin, which is known to be released following high-intensity radiation damage.

5847 Cation Exchange between Cells and Plasma of Mammalian Blood. II. Sodium and Potassium Ex-

BIOLOGY AND MEDICINE

change in the Sheep, Dog, Cow, and Man, and the Effect of Varying the Plasma Potassium Concentration. C. W. Sheppard and W. R. Martin. ORNL-617, nd. 37p. (See also NSA 4-2210.)

The exchange of potassium and of sodium between the erythrocytes and plasma of sheep, dogs, cattle, and men have been investigated using a radioactive tracer method. Preliminary results indicate a rough proportionality between the exchange rate and the intracellular concentration of the K and Na cations. In human blood, the K exchange rate is remarkably independent of the concentration of the plasma K. These results strongly suggest that the earlier concept of cation impermeability must be replaced by a biological regulation process. The role played by specific K accumulation in the cation regulation process, an unexplained tenfold difference between percentage exchange rates for K and Na, the rapid variation of the K exchange rate with temperature, and the relation of the mechanism of radiation damage to the cation exchange regulation mechanism are discussed.

5848 Behavior of Thorium in Gravid and Non-gravid Rats. A. Engels, W. Maurer, and A. Niklas. Exptl. Med. 115, No. 5, 525-33(1950)(in German).

In a previous paper (Deut. med. Rundschau 3, 261(1949)) the authors have shown that thorium injected into animals was accumulated mainly in the liver, the spleen, and the bones. In the present work the same technique (intravenous introduction of thorium nitrate into a rat's tail, Th being labeled with UX_1) was applied to a study of differences in the distribution of Th in gravid and nongravid rats. It was found that the above mentioned organs were chiefly involved in both cases; however, in gravid animals the Th concentrations were lower, and the decrease of Th content in blood proceeded more slowly than in nongravid individuals. It was also established that the volume of blood contained in the adrenals of a gravid rat is twice that found in those of a nongravid animal, the body weight being only slightly increased in the former case.

5849 The Biological Synthesis of "Labile Methyl Groups." Vincent du Vigneaud, Charlotte Ressler, and Julian R. Rachele. Science 112, 267-71(1950) Sept. 8.

The synthesis of biologically-labile methyl groups by intestinal bacteria-free rats kept on a methyl-free diet has been studied using deuterium as a tracer. The tracer was administered as D_2O in sterilized drinking water and was determined in the synthesized methyl groups by mass spectrometry. An extensive review of earlier investigations is given. 31 references.

5850 A Maternal Influence on the Incorporation of Methionine into Liver Protein. Robert J. Rutman. Science 112, 252(1950) Sept. 1.

The rate of incorporation of S^{35}-labeled dl-methionine into liver-slice proteins of rats has been shown to be genetically controlled. Experiments are reported demonstrating the strong influence, transmitted through the milk, of maternal genotype on the process in vitro under foster nursing. When the methionine incorporation rate in low-rate strains is raised to the level of the high-rate nurse a marked increase in growth occurs, while high-rate strains are uninfluenced by the milk of their low-rate foster parent. The generality of this phenomenon is discussed.

BIOLOGY AND MEDICINE

5851 A Radiobiological Study of Four Organic Phosphates. C. C. Roan, H. E. Fernando, and C. W. Kearns. J. Econ. Entomol. 43, 319-25(1950) June.

Four organic phosphates, tetraethyl pyrophosphate, o,o-diethyl-o,p-nitrophenyl phosphate, tetraisopropyl pyrophosphate, and tetra-n-butyl pyrophosphate labeled with P^{32} were employed in an investigation of their permeabilities, transport, and metabolism in the American roach.

CHEMISTRY

5852 The Relative Rates of Reaction of Hydrogen and Tritium Hydride with Chlorine. W. M. Jones. AECU-926, nd. 25p.

The ratio of the specific rate constant for H_2 to that for HT in the photochemical reaction with chlorine has been determined at four temperatures and is represented by $R = (1.35 \pm 0.03) \exp[(552 \pm 7)/RT]$ to within about 0.3%. The ratio is found to be the same when the reaction is initiated by the tritium β-particles. The data are considered from the viewpoint of the theory of absolute reaction rates. (auth)

5853 The Vapor Pressures of Hydrogen, Deuterium, and Tritium up to Three Atmospheres. E. R. Grilly. AECU-928, nd. 15p.

The vapor pressures of hydrogen, deuterium, and tritium have been measured in the temperature ranges 14 to 24.5, 14 to 27.8, and 14 to 29°K, respectively, and the following empirical equations derived: H_2, $\log P_{mm\ Hg}(14\text{-}20°K) = 4.66687 - 44.9569/T + 0.020537T$, $\log P(19.5\text{-}24.5°K) = 5.5567 - 54.650/T + 10.9 \times 10^{-4}(T-22)^2$; D_2, $\log P(\text{solid}) = 6.2100 - 77.077/T + 28.8 \times 10^{-4}(T-16.5)^2$, $\log P(\text{liq.}) = 5.8404 - 70.044/T + 4.59 \times 10^{-4}(T-23)^2$; T_2, $\log P(\text{solid}) = 6.2510 - 83.370/T$, $\log P(\text{liq.}) = 5.9444 - 76.323/T$. From these equations the following thermal properties have been calculated for H_2, D_2, and T_2, in that order: triple point temperature, 13.96, 18.73, 20.27°K; triple point pressure, 54.0, 128.6, 157.4 mm Hg; normal boiling point, 20.39, 23.67, 24.92°K; heat of sublimation, 247 (13.96°K), 364 (18.73°K), 376 (19.0°K) cal/mole; heat of vaporization at normal boiling point, 216, 293, 322 cal/mole. Deviations are listed, reliability is discussed, and the apparatus, designed essentially for small volume, is described.

5854 The Determination of Thorium in Low-grade Ores. Brenton H. Dickson and David Kaufman. AECD-2887, Mar. 10, 1950. 21p.

A method is described for the determination of thorium in black sands. Experimental work justifying the various steps in the procedure is presented. The modified method consists of the following steps: decomposition of the sample by fusion with sodium peroxide, precipitation of thorium with fluoride, dissolution of the fluoride precipitate and precipitation with sodium hydroxide, dissolution of hydroxide precipitate and precipitation with excess ammonia, reprecipitation with ammonia at controlled pH, and dissolution of the ammonia precipitate and final precipitation of thorium with peroxide, oxalate, or iodate. (auth)

CHEMISTRY

5855 A Rapid, Simple Method for the Determination of the Radon Content of Water. R. C. Thorburn and J. W. Healy. HW-18321, June 29, 1950. 15p.

A method which requires only 20 to 25 min for a complete analysis of the radon content of water is presented. Except for a beta counter, only standard laboratory equipment is utilized. The amount of radon is determined by separating the radon daughters and measuring the associated activity, since for each disintegration of radon there is one disintegration from each daughter.

5856 Progress Report for December 1949. Carl G. Moore, D. S. McKinney, and J. C. Warner. Carnegie Institute of Technology. NYO-543, nd. 4p.

The progress of studies on the hydrogen overvoltage and anodic and cathodic polarization characteristics of titanium and zirconium and on the mixed color method for the determination of zinc is reported.

5857 The Determination of Copper in Uranium Copper Alloys. M. Gibson. Atomic Energy Research Establishment Report AERE C/R-526, May 1950. 6p.

The alloy is dissolved in the minimum amount of nitric acid, the acidity of the solution is adjusted and an electrolysis at approximately 2 amp is carried out. The deposit is redissolved and then re-electrolyzed. The method is suitable for the determination of copper over the range 0.1 to 100%. In the higher percentages an aliquot should be chosen so that the weight of copper does not exceed 0.3 g. The uncertainty of the method should not be worse than ±0.2% in the high percentages and not worse than ±4.0% in the lower regions. (auth)

5858 The Measurement of Radioactive Hydrogen in Solid Samples. Comparison with Gas Counting. Maxwell Leigh Eidinoff and Joseph E. Knoll. Science 112, 250-1(1950) Sept. 1.

Experiments are reported which demonstrate that solid tritium-labeled compounds, suitably plated out on a sample pan which is then placed under a windowless counter, can be measured with satisfactory precision. The principal disadvantage of the solid-counting procedure arises from the weak energy of the β particles emitted by radioactive hydrogen leading to an infinite thickness of less than 1 mg/cm^2. The most important advantage is the elimination of the time-consuming steps in the gas-counting measurement. Further, the compound is not destroyed during the analysis. The compound selected for study was methyl-3-α-acetoxycholinate tritium-labeled in the 11 and 12 positions. Comparison of solid- and gas-counting demonstrates the complementary nature of the methods in biochemical studies.

5859 Organic Compounds in Radiochemistry. K. Starke. Chemistry in Canada 2, 27-31(1950) July.

The use of organic compounds in radiochemistry is considered critically from the nuclear, physical, and chemical points of view. Organic solvents and reagents become more important as quantities which have to be dissolved or separated become smaller. What is true for micro- and ultramicrochemical quantities of material is also true for unweighable amounts in radiochemistry. 43 references.

CHEMISTRY

5860 A Rapid Semimicro Method for the Determination of C^{14}. Paul V. Harper, Jr., William B. Neal, Jr., and Georgiana R. Rogers. J. Lab. Clin. Med. 36, 321-4 (1950) Aug.

A method is described for the determination of C^{14} in small samples of organic material. At least four samples per hour may be oxidized easily. The resultant $C^{14}O_2$ may be trapped as $BaCO_3$ and prepared for counting. Samples as small as 0.2 mg of carbon may be analyzed within the limits of counting error and weighing error of the barium carbonate samples. (auth)

5861 The Influence of Deuterium Oxide on Germination. Helen Anne Crumley and Samuel L. Meyer. J. Tenn. Acad. Sci. 25, 171-86(1950) Aug. 7.

Results of investigations indicate that seeds of clover, radish, tobacco, Kentucky bluegrass, and spores of the black loose smut of barley and of the Cord Moss germinated in deuterium oxide in concentrations up to 99.8%. Initiation of germination was delayed by D_2O in all instances but in the case of the smut and Cord Moss the effect was particularly apparent in high concentrations. Subsequent development of the smut and Cord Moss was retarded appreciably only in high concentrations, whereas delay in initiation and degree of retardation of germination in the seeds increased with the concentration. The most plausible explanation of these results is that the rate of diffusion of water into the seeds and spores and the reaction rates involving water within the cells decreases with increasing concentration of D_2O because of the greater mass of deuterium. (auth)

5862 Optical Activity in Compounds Containing Deuterium. II. 3-Deutero-trans-p-menthane. Elliot R. Alexander. J. Am. Chem. Soc. 72, 3796-7(1950) Aug. (Note).

Optically active 3-deutero-trans-p-menthane has been prepared by the reduction of l-menthyl p-toluenesulfonate with lithium aluminum deuteride. The optical activity depends solely on the replacement of hydrogen atoms by deuterium atoms since trans-p-menthane is inactive. $[\alpha]^{25}D = -0.09 \pm 0.01°$.

5863 Vapor Pressure and Critical Constants of HD and D_2. Harold J. Hoge. Natl. Bur. Standards. Mar. 9, 1950. 4p. (AEC File No. NP-1484.)

The vapor pressure of HD has been measured from 114 mm Hg to the critical point and the vapor pressure of D_2 from 319 mm Hg to the critical point. The critical constants of HD are P_c = 11.2 m Hg (14.7 atm), T_c = 35.9°K. On the basis of a very few exploratory measurements, the critical temperature of D_2 is definitely above 38.2°K — probably near 38.8°K. The critical pressure corresponding is about 13.2 m Hg (17.4 atm). Further analysis of the data will yield approximate values of the critical density. The vapor-pressure data for HD and D_2 are given in tables.

5864 The Action of Elementary Fluorine upon Organic Compounds. XIII. The Vapor-phase Fluorination of Trichloroethylene. Murray Hauptschein and Lucius A. Bigelow. J. Am. Chem. Soc. 72, 3423-6(1950) Aug.

CHEMISTRY

A study of the direct fluorination of trichloroethylene in the vapor phase over a close metal packing has been made under a number of mild operating conditions. This fluorination has been shown to take a somewhat directed, rather than a completely random course. The reaction proceeded in considerable part by certain preferred routes which were established by determining the principal precursors of a number of the products. The results of this vapor-phase fluorination are compared with those reported by Miller (J. Am. Chem. Soc. 62, 341(1940)), who fluorinated the same compound in the liquid phase, and are found to be distinctly different. Certain theories which account well for these facts are presented. (auth)

5865 The Degradation of Silver Trifluoroacetate to Trifluoroiodomethane. Albert L. Henne and William G. Finnegan. J. Am. Chem. Soc. 72, 3806-7(1950) Aug. (Note).

A one-step synthesis of CF_3I from commercially available reagents has been found. Careful heat decomposition of an equimolecular mixture of dry CF_3COOAg and I_2 gives an 80% yield of CF_3I.

5866 Influence of a CF_3 Group on an Adjacent Double Bond. Albert L. Henne and Samuel Kaye. J. Am. Chem. Soc. 72, 3369(1950) Aug.

In $CF_3CH=CH_2$, the CF_3 group "drains" the double bond and polarizes it in a manner to make the central carbon the more negative; this makes the addition of HCl or HBr difficult, and directs it to form $CF_3CH_2CH_2Cl$ or $CF_3CH_2CH_2Br$ exclusively. Catalytic hydrogenation to $CF_3CH_2CH_3$ proceeds quantitatively under experimental conditions adequate for aniline reduction. (auth)

5867 A New Synthesis of Ethyl Trifluoroacetate. T. R. Norton. J. Am. Chem. Soc. 72, 3527-8(1950) Aug.

Trifluoroacetic acid and its ethyl, propyl, and isopropyl esters have been prepared by a method involving simple hydrolysis at atmospheric pressure, which gives high yields. The isolated intermediates are trichloroacetonitrile, 2,4,6-tris-(trichloromethyl)-1,3,5-triazine, and 2,4,6-tris-(trifluoromethyl)-1,3,5-triazine.

5868 Nitration of 1,1,1-Trifluoropropane. E. T. McBee, H. B. Hass, and I. M. Robinson. J. Am. Chem. Soc. 72, 3579-80(1950) Aug.

The vapor-phase nitration of 1,1,1-trifluoropropane has been found to produce 1,1,1-trifluoro-3-nitropropane and 1,1,1-trifluoronitroethane. Although nitromethane was also an expected product, none was detected or isolated. Failure to obtain other nitration products may be attributed to the stabilizing effect of the trifluoromethyl group. (auth)

5869 Oxidative Nitration of 1,1,1-Trifluoropropane. Trifluoroacetaldehyde. Harold Schechter and Franklin Conrad. J. Am. Chem. Soc. 72, 3371-3(1950) Aug.

The nitration of 1,1,1-trifluoropropane with nitric acid in the presence of oxygen at 437-462°C yields 1,1,1-trifluoro-3-nitropropane (16%) and trifluoroacetaldehyde (20-24%). The specificity of the nitration reaction is attributed to the inductive effect of the trifluoromethyl group. Trifluoroacetaldehyde resembles chloral in many of its properties. It forms a stable hydrate, undergoes a typical haloform reaction, and polymerizes during storage. The polymerization is reversed by heat or dilute bases. Infrared absorption spectra are given. (auth)

5870 The Preparation of Complex Fluoro-acid Salts of Metals and of the Nitronium Ion by Means of Bromine Trifluoride. A. A. Woolf and H. J. Emeléus. J. Chem. Soc. 1950, 1050-1. Apr.

Salts of complex fluoro-acids have been prepared by two general methods. In the first an oxysalt is treated with bromine trifluoride, and in the second, of wider application, mixtures of substances which may be metals, oxides, oxysalts, or halides, capable of reacting as "acids" and "bases" in bromine trifluoride, are treated with the latter. The conversion of borates into tetrafluoroborates is an example of the first method; the reaction of a mixture of silver and arsenious oxide with bromine trifluoride to yield silver hexafluoroarsenate is an example of the second. The second procedure has also been used in the production of nitronium salts. Dinitrogen tetroxide, boric oxide, and bromine trifluoride, for instance, yielded nitronium tetrafluoroborate. Nitronium tetrafluoroaurate, hexafluorostannate, hexafluorophosphate, hexafluoroarsenate, and hexafluoroantimonate were produced similarly. (auth)

5871 The Preparation of Hexafluoroacetone. Albert L. Henne, John W. Shepard, and Evan J. Young. J. Am. Chem. Soc. 72, 3577-9(1950) Aug.

Hexafluoroacetone was prepared in 60% yield by permanganic oxidation of $(CF_3)_2C=CCl_2$, in an operation which could easily be improved. The needed olefin was obtained from $CF_3C(CH_3)ClCH_2Cl$ in a sequence of steps, each of which gave a 90 to 95% yield when the unreacted reagents were reworked. This $CF_3C(CH_3)ClCH_2Cl$ was prepared practically quantitatively from trifluoroacetic acid; it is also obtainable from isocrotyl chloride by a sequence of simple steps which would be cheaper for large quantities. (auth)

5872 The Preparation of Hexafluoroniobates, Hexafluorotantalates, and Hexafluorobismuthates by Means of Bromine Trifluoride. V. Gutmann and H. J. Emeléus. J. Chem. Soc. 1950, 1046-50. Apr.

Niobium and tantalum, or their pentoxides, react with bromine trifluoride to give the fluorobromonium hexafluoroniobate and hexafluorotantalate, $(BrF_2)NbF_6$ and $(BrF_2)TaF_6$, which act as "acids" in bromine trifluoride and are neutralized by bromofluorides to give hexafluoroniobates, $MNbF_6$, and hexafluorotantalates, $MTaF_6$, respectively. Salts of lithium, sodium, potassium, rubidium, and cesium were prepared in this way, but the calcium and barium salts always contained bromofluoride, the formation of which is believed to be due to solvolysis. Bismuth pentoxide containing 70% of quinquevalent bismuth reacted with bromine trifluoride to give bismuth oxytrifluoride containing bismuth trifluoride. Bismuth pentafluoride formed with bromine trifluoride the fluorobromonium hexafluorobismuthate, $(BrF_2)BiF_6$, which behaved as an "acid" in bromine trifluoride and reacted with silver bromofluoride, forming silver hexafluorobismuthate. The hexafluorobismuthates of sodium, potassium, and rubidium contained bromofluorides, probably owing to solvolysis in bromine trifluoride. (auth)

CHEMISTRY

5873 The Preparation of Trifluorinated Aldehydes. Albert L. Henne, Ralph L. Pelley, and Robert M. Alm. J. Am. Chem. Soc. 72, 3370-1(1950) Aug.

To synthesize an aldehyde bearing a CF_3 group, conventional oxidation of the corresponding alcohol is adequate if the CF_3 is not adjacent to the carbonyl group. For the synthesis of fluoral, CF_3CHO, only the low temperature reduction of CF_3CN with lithium aluminum hydride was found effective. The preparation of CF_3CHO, CF_3CH_2CHO and $CF_3CH_2CO_2H$ are described. (auth)

5874 Trifluoromethylsulfur Pentafluoride. Gene A. Silvey and George H. Cady. J. Am. Chem. Soc. 72, 3624-6(1950) Aug.

Methyl mercaptan was fluorinated by cobalt trifluoride at 250°C and also by the action of an excess of fluorine, diluted with nitrogen, in the presence of copper turnings coated with silver fluorides, at 200°C. Both methods produced trifluoromethylsulfur pentafluoride, CF_3SF_5, as one of the products. The second method produced what is regarded as a monohydrogen derivative, $CSHF_7$. A preparative method which gave the highest yield of trifluoromethylsulfur pentafluoride was the reaction of carbon disulfide with cobalt trifluoride at approximately 250°C. Trifluoromethylsulfur pentafluoride boils at -20.4°C, melts at -86.9 ± 0.2°C, and has a transition point at -153.3 ± 0.3°C. No evidence was found for the reaction of the gas with 6N sodium hydroxide at room temperature. This gas reacts rapidly with alkali metals only at dull red heat. It is a very good gaseous insulator at low pressure, but is decomposed by spark-over discharge, yielding carbon tetrafluoride and sulfur tetrafluoride. $CSHF_7$ boils at 5.1°C and melts at approximately -87°C. It reacts rapidly with 6N sodium hydroxide at room temperature, all the fluorine atoms being removed. The vapor pressures and heats of vaporization of CF_3SF_5 and $CSHF_7$ are given. (auth)

5875 A Battery Charger and Control Circuit for the Beckman Spectrophotometer. Robert Wellnitz and Anthony R. Ronzio. AECU-922, nd. 2p.

A description and a circuit sketch are presented of an apparatus to maintain the necessary stable current for a Beckman ultraviolet spectrophotometer in the making of accurate absorption spectrum measurements. The control is based on the parallel arrangement of two storage batteries.

5876 Manuals for Brookhaven National Laboratory. Book No. 6. Laboratories Manual (Design, Operation, Maintenance). H. K. Ferguson Co. M-4419(HKF-17), July 1949. 230p.

This book, which is No. 6 in a series of seven manuals dealing with the Pile Complex, covers the major units (of those installed by H. K. Ferguson Company) not directly involved in the pile operation but associated with it. These are the Pile Building (701), the Pile Laboratories (703), the Hot Laboratory (801), and the Waste System (811). The design, maintenance, and operation of these units are all covered in the present single volume. The major emphasis is on presenting information for the operation and maintenance of equipment. Considerable use is made of manufacturers' bulletins, which are included in this book (in separate covers). Descriptions of structures and equipment are brief, and design methods and considerations are touched on chiefly where the features concerned are not conventional.

CHEMISTRY

5877 Apparatus for the Determination of Interaction Coefficients of Gas Mixtures by the Method of Edwards and Roseveare. Robert A. Gorski and John G. Miller. University of Pennsylvania. June 1950. 63p. (AEC File No. NP-1634.)

The method of Edwards and Roseveare (J. Am. Chem. Soc. 64, 2816(1942)) for the measurement of interaction coefficients of gas mixtures is described. Construction of an improved apparatus for the use of this method is described and plans for its use are given. 11 references.

5878 Controlling Fume Hood Exhaust in Atomic Energy Laboratories. Homer B. Clay. Heating Piping and Air Conditioning 22, No. 7, 77-83(1950) July.

Because of the unusual hazards to health presented by many materials used in atomic energy work, special attention must be given to proper regulation of fume hoods and exhaust systems. Consideration is given to the design of the hood or canopy to provide the proper air pattern for collecting all or some part of the contamination from the source, the design and construction of ducts to carry off the materials without excess condensation or concentration of contamination at any point, the collection of contamination before releasing the transport medium, and the design and application of fans and blowers used in creating the proper exhaust air volumes.

5879 Substituted Methanes. II. Vibrational Spectra and Calculated Thermodynamic Properties of Deuterotribromomethane. Salvador M. Ferigle, Forrest F. Cleveland, William M. Boyer, and Richard B. Bernstein. J. Chem. Phys. 18, 1073-5(1950) Aug.

Raman displacements, semiquantitative relative intensities, quantitative depolarization factors, and wave numbers and per cent transmission for the infrared bands in the region 400 to 5000 cm^{-1} have been obtained for CBr_3D. Details about the measurement of the depolarization factors are given. Thermodynamic properties, including heat content, free energy, heat capacity, and entropy, have been calculated from the spectroscopic and molecular structure data for eight temperatures from 298.16 to 1000°K. (auth)

5880 Substituted Methanes. III. Raman Spectra, Assignments, and Force Constants for Some Trichloromethanes. James P. Zietlow, Forrest F. Cleveland, and Arnold G. Meister. J. Chem. Phys. 18, 1076-80(1950) Aug.

Raman displacements, semiquantitative relative intensities, and precise depolarization factors for trichloromethane, fluorotrichloromethane, and bromotrichloromethane were obtained in the liquid state. Several overtones and combination bands hitherto unreported are given and frequency assignments are made. The Raman data in the literature for CCl_3H, CCl_3D, CCl_3F, CCl_4, and CCl_3Br in the liquid state have been collected and the probable values ascertained. Force constants in modified valence force potential functions containing all possible interaction constants were calculated for the five molecules. (auth)

5881 Substituted Methanes. IV. Vibrational Spectra and Calculated Thermodynamic Properties of Deuterotrichloromethane. John R. Madigan, Forrest F.

Cleveland, William M. Boyer, and Richard B. Bernstein. J. Chem. Phys. 18, 1081-3(1950) Aug.

Raman displacements, semiquantitative relative intensities, quantitative depolarization factors, and wave numbers and per cent transmission for the infrared bands in the region 400 to 5000 cm^{-1} have been obtained for CCl_3D. Thermodynamic properties, including heat content, free energy, entropy, and heat capacity, have been calculated from the spectroscopic and molecular structure data, to a rigid-rotator, harmonic-oscillator approximation, for nine temperatures from 298.16 to 1000°K. (auth)

5882 A Thermal Reaction in Neutron-Irradiated Permanganates. A. H. W. Aten, Jr., and J. B. M. van Berkum. J. Am. Chem. Soc. 72, 2373(1950) July (Note).

Following the method of Green et al (Nature 164, 788 (1949)), the authors irradiated crystals of potassium permanganate with slow neutrons and then heated them to 180°C. On chemical separation, the reduced state was found to have about 30% of the total activity while in unheated controls it had about 75%.

5883 The Electrolytic Dissociation of Lanthanum Ferricyanide in Mixed Solvents. J. C. James. J. Chem. Soc. 1950, 1094-5. Apr.

Conductivity measurements are reported for dilute aqueous solutions of lanthanum ferricyanide in binary mixtures of water with dioxan, acetone, ethylene glycol, and ethanol at 25°C. Dissociation constants have been derived, and it is shown that, for the water-rich mixtures studied, the variation of dissociation constants with the dielectric constant of the medium can be accounted for satisfactorily on electrostatic grounds. (auth)

5884 Polynuclear Complexes of Lanthanon Sulphates. R. C. Vickery. J. Chem. Soc. 1950, 1101-4. Apr.

The soluble complexes formed by interaction of lanthanon alkali sulfates with ammonium acetate are described and their application to rare-earth fractionation is studied. It is shown that fractional decomposition of the complex gives a rapid separation of lanthanum. Fractional crystallization is not thus applicable. A fluorescence test for neodymium is described. (auth)

5885 Micro Synthesis with Tracer Elements. XIV. The Preparation of 3,3'-Methylene-C^{14}-bis(4-Hydroxy Coumarin). A. Murray, III, C. W. Bills, and A. R. Ronzio. AECU-931, nd. 1p.

The document is reproduced below in its entirety.

A sample of 3,3'-methylene-C^{14}-bis(4-hydroxy coumarin), "dicoumarol," was desired to study the mode of activity of this drug on the enzyme system of blood. The drug has a strong anti-coagulant effect. Since pronounced hemorrhage is a phenomenon of radiation exposure, the study of the blood coagulation process through use of this drug should give some insight into the over-all picture of radiation injury.

Experimental. To a solution of 3.609 (22.2 mM) of 4-hydroxy coumarin in 660 ml of boiling water in a 1 liter flask was added, through a reflux condenser, 60 ml of solution made by diluting 1.25 ml of 21% solution of formaldehyde in 10% methanol (d_{27} = 1.021) of which 0.30% of the aldehyde (1.89 mc) was labeled with C^{14}. The total quantity of aldehyde was 8.94 mM. The reaction mixture became turbid almost immediately and the very insoluble colorless "dicoumarol" began to separate within 2 min. After refluxing ½ hr the product was filtered off in a Buchner funnel while the solution was still hot. The compound was washed with 500 ml of boiling water and dried in a vacuum over calcium chloride. The crude product weighed 3.10489 g (103.3%). After purification by recrystallization from 50 ml of cyclohexanone, the yield was 2.9443 g of colorless needles melting at 281 to 283° (98.0% of theory). The specific activity of the "dicoumarol" thus prepared was 0.00184 mc/mg. (auth)

5886 Studies on the Formation of Sodium Cyanide from Barium Carbonate and Sodium Azide. G. O. Henneberry and B. E. Baker. Can. J. Research 28B, 345-51(1950) July.

The reaction of C^{14}-labeled $BaCO_3$ with sodium azide to give labeled NaCN was reported by Adamson (J. Am. Chem. Soc. 69, 2564(1947)). His procedure consisted of heating NaN_3 with $BaCO_3$ in the ratio of 10 to 1 at the decomposition point of the azide, and finally fusing the mixture at a dull red heat. Attempts to prepare NaCN by this method, using nonradioactive materials, gave only half the yields reported by Adamson, and explosions occurred very frequently in the initial heating operation. An apparatus has been designed and a procedure developed whereby the rate of the initial reaction can be controlled and explosions prevented. The effect of fusion temperature and length of fusion time have been studied. Yields of 79.4-84.9% have been obtained.

5887 Studies of the Exchange Reactions of Solid Oxides. Part II. The Exchange of Oxygen between Water Vapour and Certain Metallic Oxides. E. Whalley and E. R. S. Winter. J. Chem. Soc. 1950, 1175-7. Apr.

Experiments are reported on the exchange of O^{18} between water vapor and γ-Al_2O_3, ThO_2, and TiO_2; the amount of exchange is discussed in relation to the water content and the surface area (as determined by nitrogen-adsorption isotherms) of the powders. (auth)

5888 Isolation of Microgram Quantities of Naturally-occurring Plutonium and Examination of Its Isotopic Composition. D. C. Peppard, M. H. Studier, M. V. Gergel, G. W. Mason, J. C. Sullivan, and J. F. Mech. AECD-2890, June 2, 1950. Decl. June 30, 1950. 11p.

The plutonium content of a Belgian Congo pitchblende concentrate (45.3% U) has been determined as 7.0 ± 0.7 parts of Pu^{239} in 10^{12} parts of concentrate. This value is 700 times the value reported for the Pu^{239} content of a Canadian pitchblende concentrate. The quantity of Pu^{239} found is probably too high to be accounted for by the absorption by U^{238} of neutrons formed by spontaneous fission of uranium. A mechanism involving interaction of the more energetic alphas of the uranium series and light elements such as oxygen, magnesium, and silicon to yield neutrons is suggested as a further source of neutrons. No isotopes of plutonium other than Pu^{239} have been demonstrated to be present in the product. Upper limits are set. The methods used to separate chemically the microgram quantities of Pu and to study the isotopic composition are described.

5889 Chemical Properties of Californium. K. Street, Jr., S. G. Thompson, and G. T. Seaborg. AECD-2891, June 12, 1950. Decl. July 2, 1950. 12p.

CHEMISTRY

Californium, element 98, produced by the helium-ion bombardment of Cm^{242}, has been chemically separated and identified by the use of ion exchange adsorption methods employing the resin Dowex-50. The new element appears in the eka-dysprosium position on elution curves containing Bk and Cm reference points. Small amounts of Cf(~50 c/m) have been isolated and tracer chemical experiments performed. The Cf was followed in experimental work by pulse analysis for the 7.1-Mev α particles. Attempts have been made to oxidize the Cf(III) to higher oxidation states and it is concluded that these are not stable in aqueous solution or that the rates of oxidation are slow. All the chemical properties of Cf further confirm the close analogy between the lanthanide and actinide series.

5890 Heats of Reaction of Some Oxides of Americium and Praseodymium with Nitric Acid and an Estimate of the Potentials of the Am(III)-Am(IV) and Pr(III)-Pr(IV) Couples. L. Eyring, B. B. Cunningham, and H. R. Lohr. AECD-2897, July 7, 1950. Decl. Aug. 18, 1950. 19p.

The work described in this paper was undertaken for the purpose of evaluating the magnitude of the potentials more precisely. Procedures and results obtained for the above heats of reaction and related information are reported.

5891 The Pentavalent State of Americium. L. B. Werner and I. Perlman. AECD-2898, July 24, 1950. Decl. Aug. 18, 1950. 8p.

Spectrophotometric and titration methods were used to establish the pentavalent state of americium. On addition of NaOCl to a K_2CO_3–Am(III) solution at 95°C, the absorption peaks of Am(III) decreased to zero and a precipitate was formed. A reducing agent, $Na_2S_2O_4$, reversed this behavior. Solution of the precipitate in 0.1M H_2SO_4 gave a colorless solution in which the strength of the Am(III) absorption bands indicated the concentration of the trivalent state to be only 2%. A corrected absorption spectrum is given which was taken to be characteristic of Am(V) in 0.1M H_2SO_4 solution. The absorption peaks are at 5150 and 7200A with molar extinction coefficients 48 and 66, respectively. A titration with ferrous ion solution showed the oxidized state to have 1.96 equivalents/mole. By analogy with Pu(V) and Np(V) ions in acid solution, Am(V) is expected to have the ionic form AmO_2^+. No attempt was made to identify the Am(V) precipitate from carbonate solution.

5892 The Potential of the Pu(III)-Pu(IV) Couple; the Hydrolysis Constant of Pu(IV). Sherman W. Rabideau and Joe F. Lemons. AECD-2903, July 18, 1950. Decl. Aug. 17, 1950. 11p.

An abstract of this document was issued as document LADC-805 and appears in Nuclear Science Abstracts as abstract 4-4862.

5893 Magnetic Susceptibilities of Some Uranium and Plutonium Salts. Norman Elliott and W. Burton Lewis. AECD-2910, Aug. 12, 1950. Decl. Aug. 29, 1950. 6p.

An abstract of this document was issued as document LADC-806 and appears in Nuclear Science Abstracts as abstract 4-4868.

CHEMISTRY

5894 New Studies in the Isolation and Properties of Curium. W. W. T. Crane and I. Perlman. AECD-2911, Aug. 3, 1950. Decl. Sept. 1, 1950. 11p.

Methods of preparation and handling of pure curium compounds are described in detail. Some experimental data bearing on the stability of the tripositive oxidation state are given. The results of an investigation of the absorption spectrum of curium, using a Baird three-meter grating spectrograph are given, together with a discussion of the relation of this spectrum to that of gadolinium, the rare-earth analog of curium. (auth)

5895 The Preparation and Some Properties of Curium Metal. J. C. Wallmann, W. W. T. Crane, and B. B. Cunningham. AECD-2912, Aug. 1, 1950. Decl. Aug. 25, 1950. 4p.

Curium metal has been prepared on the microgram scale by reduction of curium trifluoride with barium metal vapor at 1275°C, using a vacuum furnace and double-crucible system similar to that described by Fried and Davidson (J. Am. Chem. Soc. 70, 3539(1948)). The metal is silvery in appearance and about as malleable as plutonium prepared under the same conditions. The metal tarnishes more rapidly than does americium or plutonium. This is probably attributable to the radioactivity of the Cm^{242} isotope, which is sufficient to maintain the temperature of the sample from 50 to 100°C above that of the surroundings. The experimental conditions necessary to produce optimum results are discussed. The density of the metal is found to be about 7 g/cc. This is a surprisingly low value and may indicate the presence of a void in the sample.

5896 Some Observations and Comments on the Oxidation Potential of the Berkelium III-IV Couple. M. E. Jones and B. B. Cunningham. AECD-2913, Aug. 1, 1950. Decl. Aug. 25, 1950. 5p.

The oxidation of Bk(III) to Bk(IV) by various reagents has been investigated. Tracer quantities of Bk and Ce^{144} were oxidized, zirconium phenylarsonate, a specific carrier for the +4 actinide oxidation state was added, and the per cent of oxidation determined by differential counting of the precipitate. All experiments indicate a near-identity in the values of the Bk(III)/Bk(IV) and Ce(III)/Ce(IV) potentials. Because of the anticipated smaller ionic radius of Bk^{+4} it might be expected that it would hydrolyze more readily than Ce^{+4}. However, oxidation with bromate in $LiClO_4$–$HClO_4$ solutions at various hydrogen-ion concentrations and a constant ionic strength of 1 did not show any marked difference. It is concluded that the oxidation potential of the Bk(III)/Bk(IV) couple does not differ by more than 50 mv from that of the Ce(III)/Ce(IV) couple. Therefore, for the reaction $Bk(III) = Bk(IV) + e^-$, $E_f = -1.62 \pm 0.06$ v.

5897 The Absorption Spectrum of Americium. B. J. Stover, J. G. Conway, and B. B. Cunningham. AECD-2915, Aug. 3, 1950. Decl. Aug. 25, 1950. 6p.

The absorption spectra of aqueous solutions and solid compounds of americium have been investigated with a Baird three-meter grating spectrograph. The relation of the spectrum to that of other actinide and rare earth compounds is discussed. (auth)

CHEMISTRY

5898 The Autoreduction of Am(VI) and Am(V) in Dilute Acid. L. B. Asprey and S. E. Stephanou. AECU-924, nd. 5p.

The autoreduction of Am(VI) and Am(V) is found to be zero order with respect to the species being reduced and first order with respect to the total americium concentration. These results can be satisfactorily explained as due to the reaction of the americium α particles with water. Since other workers have found H_2O_2 to be a principal product of the reaction between α particles and water, this offers a reasonable explanation for the reduction observed. No direct experiments have been made to determine whether a hydrogen peroxide mechanism is involved. (auth)

5899 The Disproportionation of Americium (V). S. E. Stephanou, L. B. Asprey, and R. A. Penneman. AECU-925, nd. 9p.

Pure Am(V) was prepared in which Am(III) in alkaline carbonate solution was oxidized with sodium hypochlorite. The resulting precipitate containing Am(V) was dissolved in 6M perchloric acid to give a solution of about 0.02M in Am(V). Observations of the Am(V), (VI), and (III) absorption peaks in a Beckman Model DU spectrophotometer showed that the Am(V) peak disappeared with corresponding increases in the Am(III) and Am(VI) peaks. A discussion of the phenomena is given.

5900 Spectrophotometry of Neptunium in Perchloric Acid Solutions. R. K. Sjoblom and J. C. Hindman. ANL-4443, Apr. 14, 1950. 36p.

Details of the absorption spectra of the neptunium(III), (IV), (V), and (VI) ions in 1M perchloric acid are given. The principal bands have been tested for adherence to the Beer-Lambert Law. Vibrational fine structure has been found in the absorption spectra of Np(V) and Np(VI). As for U(VI) and Pu(VI), this fine structure is interpreted as being due to symmetrical metal-oxygen vibrations in ions of the type NpO_2^+ and NpO_2^{++}. The vibrational frequency of the Np(V) ion is 753 cm^{-1} and that of the Np(VI) ion is 715 cm^{-1} in 1M $HClO_4$. The interpretation of effect of change in perchloric acid concentration on the absorption spectra of the ions of the various oxidation states is discussed. Preliminary data on the disproportionation reaction 2 Np(V) $\rightleftharpoons$ Np(IV) + Np(VI) which has been found to occur in concentrated perchloric acid solutions is given. 21 references. (auth)

ENGINEERING

5901 Thermodynamic Diagrams for Sodium. T. H. Inatomi and W. C. Parrish. NAA-SR-62, July 13, 1950. 54p.

Temperature-entropy and Mollier charts for sodium, based on available data from the literature, are presented, and the method used for their construction is described. In the absence of constants for the more exact equations of state, the vapor phase was assumed to obey the perfect gas law. Subsequent checks with compressibility-factor data indicate that the assumption of ideality holds reasonably well for pressures as high as 103 atm. Corrections for dimerization in the vapor phase were included in the present work, although there is considerable uncertainty in the extrapolated value of the equilibrium constant for the dimerization reaction. If used in the light of these limitations, the charts should serve as a useful first approximation in thermodynamic cycle analysis. (auth)

ENGINEERING

5902 Isotopes in Industry. A. J. Swallow. Ind. Chemist 26, 297-300, 322(1950) July.

Lectures from a conference on isotopes in industry are reported concerning elementary nuclear physics, detection and measurement of radioactivity, construction of a G-M counter, elementary radiochemistry, use of stable isotopes as carriers, specific applications of radioactive isotopes, the dilution technique for measuring the amount of one component in a nonradioactive mixture, and hazards in industrial applications of isotopes.

5903 Wax Wear Resistance. Bernice Cummings. Soap and Sanitary Chemicals 1950, 114-15. Aug.

Work with radioactive Co^{60} in evaluating the efficiency of popular brands of floor waxes of the self-polishing or water emulsion variety is reported. Each wax was applied to a surface, after incorporation of the tracer, and its removal by abrasive action was measured by the loss in activity.

5904 Why Industry Misses Atom Opportunities. Modern Ind. 20, 49-51(1950) July 15.

A discussion of industrial uses of radioisotopes and a survey of reasons extended by manufacturers as to why applications of proven value have not been used in their operations are presented. Nearly all replies to a questionnaire reflected a lack of trained personnel.

5905 A Convenient Leak for Testing Helium Leak Detectors. G. H. Jenks. Rev. Sci. Instruments 21, 674-5 (1950) July (Laboratory note).

In the use of helium leak detectors, it is frequently desirable to test the sensitivity of the instruments by admitting helium gas to the system at known slow rates. The methods commonly employed in admitting the gas make use of fine capillaries of different types. The capillary leaks, however, are troublesome to use because of the ease with which they are stopped or their calibrations changed. A "leak" of the diffusion type has been in use for several weeks and so far has operated very satisfactorily. The design of the leak is shown in an accompanying sketch. The rate at which helium diffuses through the leak is such that a detector registers a steady deflection of one-tenth of the most sensitive full-scale deflection.

5906 A Simple Mass Spectrometer for Leak Hunting. A. Storruste. K. Norske Videnskab Selskabs Forh. 22, No. 6, 18-20(1949).

A small (50 by 38 mm) mass spectrometer for leakage hunting is described, in which hydrogen is used instead of the more expensive helium, and in which the radius of the ion path is only 12 mm. There is no separate evacuating system. Both the ion source and the collector box are in the magnetic field of 1350 gauss. In the pressure range 10^{-5} to 10^{-3} mm Hg, the maxima for H^1, H^2, and H^3 correspond to accelerating voltages 100, 50, and 35 v, respectively. Either a d-c amplifier with a meter or an oscillograph are used for the measurement of the output current.

MINERALOGY, METALLURGY AND CERAMICS

5907 The Choice of the Proper Refractory for the Casting of High Melting Electropositive Metals. Leo Brewer. UCRL-762, June 23, 1950. 20p.

A method of choosing and testing possible container materials for use in casting titanium, zirconium, and other high

melting electropositive metals is discussed. Titanium is used as an example. This discussion is restricted to refractory materials with melting points above 2000°K and to compounds, such as oxides, sulfides, nitrides, carbides, silicides, and borides.

5908 Preparation of Ductile Vanadium by Calcium Reduction. R. K. McKechnie and A. U. Seybolt. AECD-2865, nd. Decl. Feb. 23, 1950. 17p.

As a preliminary to the study of the properties of pure, ductile vanadium metal, research on the preparation of the metal has been necessary since vanadium is not available commercially in a form sufficiently pure to be ductile. The reduction of V_2O_5 with calcium metal in a steel bomb has been studied. The addition of $CaCl_2$ to the charge produced no observable benefits. Lowering of the melting point of the slag was obtained by the addition of iodine; the use of aluminum or aluminium oxide for this purpose produces brittle metal. Commercial V_2O_5 may contain sufficient nitrogen to produce brittleness. Heating in a stream of wet oxygen is shown to reduce the nitrogen content to a satisfactory level. The effect of other gases and the optimum charge are discussed.

5909 The Heats of Formation of Sodium-Tin Alloys. Raleigh L. McKisson and LeRoy A. Bromley. UCRL-689, May 1, 1950. 22p.

A new high-temperature calorimeter was used to measure the heats of formation of liquid sodium-tin alloys at 880°K. The ΔH_{f880} of the alloys of composition NaSn, $Na_{1.105}Sn$, and Na_2Sn are found to be -4.80 ± 0.14, -4.86 ± 0.04, and -4.03 ± 0.08 kcal/g atom alloy, respectively. In addition to these results, a curve of ΔH_{f880} vs mole fraction sodium is presented. These values have been qualitatively compared with those of other workers and tend to agree with the values given by Kubaschewski and Seith (Z. Elektrochem. 47, 433, (1941)), and to disagree with those of Biltz and Meyer (Z. anorg. u. allgem. Chem. 176, 23, (1928)). (auth)

5910 Heterogeneity of Surfaces. Dual Surface Studies. Adsorption of Gases on Metals. Lehigh University. Technical Report No. 2, June 26, 1950. 46p. (AEC File No. NP-1628.)

In Part I of this report dual-surface studies of a simple, well-defined heterogeneous surface by the physical adsorption of gases are reported. The adsorption of iodine on alumina-silica gel and on known mixtures of alumina and silica gel has been measured at 101.6°C. Modifications of the gravimetric adsorption apparatus used are described. A discussion of the results on the basis of the dual-surface B.E.T. theory is given, but an analysis of the alumina and silica gel mixtures is indecisive. Part II reports preliminary gas-adsorption measurements on samples of Co, Ni, Mo, Zn, Cu, Mn, and Fe, made with the usual B.E.T. volumetric adsorption apparatus. A careful study of gas adsorption on molybdenum powder has been made. Nitrogen, argon, and oxygen isotherms of unreduced and partially reduced molybdenum powder are given, and evidence is presented for the heterogeneous nature of the corrosion process on molybdenum. A design of a modified Orr-type adsorption apparatus suitable for samples having a very low specific surface area is given. 15 references.

MINERALOGY, METALLURGY AND CERAMICS

5911 Investigation of Properties of AISI Type 310B Alloy Sheet at High Temperatures. E. E. Reynolds, J. W. Freeman, and A. E. White. National Advisory Committee for Aeronautics Technical Note. NACA-TN-2162, Aug. 1950. 37p.

The results of an investigation of the properties of AISI 310B alloy sheet (25% Cr, 20% Ni, and 2% Si) at high temperatures indicate the following. The minimum ductility in tensile tests at about 1300°F will be substantially increased by heating at 1700 to 2000°F for short time periods. Prolonged exposure (50 hr) at 1700 and 1800°F would not be expected to cause low ductility at 1300°F in annealed sheet. The low ductility at about 1300°F is probably the result of the type of precipitation occurring in that temperature range. Heating at 1700 to 1800°F results in prior precipitation and agglomeration of excess constituents which apparently reduce the embrittling precipitation process at 1300°F. Hot-rolled and cold-rolled sheet had substantially higher tensile strength up to 1800°F than annealed sheet. The ductility of the cold-rolled sheet was, in general, the lowest. A 0.16%-carbon heat had substantially higher rupture strength at 1700 and 1800°F than two 0.05%-carbon heats. Annealed sheet has higher rupture strength than hot-rolled or cold-rolled sheet, except at short time periods. The influence of prior treatment on rupture properties was not so great as was expected. Wide variation in grain size between heats was not found to influence properties definitely. (auth)

5912 Liquid-Metals Handbook. Richard N. Lyon. Washington, AEC and Bureau of Ships, Dept. of the Navy, 1950. 188p.

A survey has been made of the present uses of liquid metals excluding the metals industry and chemical reactions. Sodium-cooled valves for aircraft engines, industrial cooling by circulation of sodium, molten-metal baths for temperature control or heat treating, and mercury boilers were the chief uses found. The place that liquid metals may take in the industrial heat-transfer field is described by comparing the characteristics of alternate fluids. Several industrial applications for liquid metals are proposed for heating or cooling in the temperature range 800 to 1400°F. (auth)

5913 The Optical Emissivity of Titanium and Zirconium. F. J. Bradshaw. Proc. Phys. Soc. (London) 63B, 573-7(1950) Aug. 1.

A method of measuring the optical emissivity of titanium and zirconium using eddy-current heating is described. The specimen consisted of a cylinder of metal drilled with a small black-body hole, and its real and apparent temperatures were measured with an optical pyrometer at a mean wavelength of 0.652 μ. The variation of emissivity with temperature was investigated and the precautions taken to avoid errors are described. (auth)

5914 The Specific Heats of MgO, TiO_2, and ZrO_2 at High Temperatures. James S. Arthur. J. App. Phys. 21, 732-3(1950) Aug.

Mean specific heats were determined from 20 to 800°C for MgO, TiO_2, and ZrO_2. True specific heats C_T were then calculated for various temperatures T, assuming that $C_T = A + BT + CT^2$, A, B, and C being tabulated constants. At 350°C the true specific heats were calculated to be: MgO, 0.276; TiO_2, 0.210; ZrO_2, 0.140. (auth)

MINERALOGY, METALLURGY AND CERAMICS

5915 Thallium. Properties, Sources, Recovery, and Uses of the Element and Its Compounds. William H. Waggaman, Gladys G. Heffner, and Edwin A. Gee. U. S. Bur. of Mines Inform. Circ. 7553(1950) March. 50p.

Following brief discussions of the above items, a bibliography of 369 entries is compiled.

5916 A Glossary of Uranium- and Thorium-Bearing Minerals. Judith Weiss Frondel and Michael Fleischer. Geological Survey Circular 74, U. S. Department of the Interior (1950) April. 19p.

The glossary is divided into four categories: (1) minerals containing uranium and thorium as major constituents, (2) minerals containing minor amounts of uranium and thorium, (3) minerals that, if investigated by modern analytical methods, might show uranium or thorium content, and (4) minerals that are nonuranium- or nonthorium-bearing, but that have been reported to contain impurities or intergrowths of uranium, thorium, or rare-earth minerals.

5917 Investigation on Indian Radioactive Minerals: III. Monazite. S. K. Nandi and D. N. Sen. J. Sci. Ind. Research (India) 9, 156-60(1950) June.

The present paper deals with the chemical analysis of a specimen of cerite earth orthophosphate, collected in the Gaya district, Bihar, which contained about 12% of ThO_2. The method of analysis is detailed and the chemical composition and age of the mineral are discussed.

PHYSICS

5918 Quarterly Progress Report: April 1 - June 30, 1950. BNL-64, nd. 114p.

Physics Department. Research progress is described concerning the following: investigations of radioactivity and nuclear reactions induced by gamma rays, neutrons, and particles accelerated in the cyclotron or Van de Graaff accelerator; measurements of nuclear mass and moment; cosmic radiation and anticipated effects produced by the cosmotron; neutron diffraction studies of the solid state and measurements of coherent scattering amplitudes; and theoretical topics.

Instrumentation and Health Physics Department. Work of the Electronics Division has been concentrated on instrumentation for pulse amplitude and time analysis. Significant progress has been made on a precision timer for a time-of-flight mass spectrometer. A single-channel and a ten-channel pulse height analyzer have been built and tested. A delayed coincidence circuit with a resolving time of less than 2.8×10^{-9} sec has been developed and tested. Work has continued on the auxiliary equipment for use with pulse analyzers consisting of improvement of the precision-regulated high-voltage supplies and the design of a novel nonoverload amplifier. The crystal-growing oven is now in operation. Spectra of the newly discovered liquid scintillators have been recorded. The other major field of work has been in health physics instrumentation. Special monitoring equipment has been developed for use in the hot lab and around the accelerating machines. Miscellaneous instruments reported on include: a circuit for integrating the beam current of the 60-in. cyclotron or the Van de Graaff accelerator; a monitoring device for civilian defense applications based on a photomultiplier and cold cathode trigger tube; and two photoelectric densitometers for detecting traces of smoke.

PHYSICS

Accelerator Project. Progress concerning power, controls, magnet, magnet coil, magnetic field tests, radio-frequency system, vacuum system, and vacuum chamber of the cosmotron is reported. Maintenance and repair operations of the 60-in. cyclotron are indicated. Design and machine work on the G. E. electrostatic accelerator are mentioned.

Chemistry Department. One phase of the study of the chemistry of the heavy elements is the investigation of the absorption spectra of their salts in solutions fluid at low temperatures. Preliminary observations on the spectrum of UCl_4 solutions are reported. The general character of reactions in such systems is also being surveyed; new observations on reactions of propene with iodine at liquid air temperature are described. Tracer investigations on reaction kinetics and mechanisms which are reported include: new data for the ferrous-ferric electron-transfer exchange reaction, a radiochemical determination of the dissociation constant of ferroin, observations on the exchange of hydrocarbons with deuterium under Fischer-Tropsch synthesis conditions, a check of a proposed mechanism for the change in configuration about carbon atom C-2 in glucose (epimerization), a study of some features of the mechanism of the Willgerodt reaction, and the thermal decomposition of N_2O. The infrared spectra of isotopically substituted N_2O have been measured; force constants of the molecule have been calculated; and partition function ratios for isotopic exchange reactions have been calculated. In connection with the mass-spectrometric investigation of isotopic molecules, a knowledge of the effect of isotopic substitution on mass-spectra patterns is important; an approximate method for calculating this effect and some experimental tests of it are reported. The relative efficiencies for the collection of positive ions of different e/m ratios in a Nier-type mass spectrometer have also been studied. Two studies of an analytical nature are included, one on a spectrophotometric method for the determination of Ce(IV), and one on a new test for traces of organic matter in water. The nuclear problems reported on include the recoil following neutrino emission in Be^7, the half-life of I^{129}, and the genetic relationship of the isomers of Ag^{110}.

Reactor Science and Engineering Department. Work on the systemics of even-even alpha emitters, the electron capture process in K^{40}, recovery of I^{132}, radioactive waste concentration, meteorology, and geology is reported.

Biological and Medical Departments. Brief reports concerning biological effects of radiation on various plants and animals, tracer work, and experiments from the medical standpoint are included. (auth)

5919 Minutes of Joint Meeting of Nuclear Shielding Project Personnel and Navy Representatives. MIT Nuclear Shielding Project. Bur. of Ships and Office of Naval Research. AEC File No. NP-1455, Aug. 19, 1949. 60p.

Talks by members of the group are presented which were concerned with the following: a survey of the M.I.T. nuclear radiation shielding project to decrease shielding volume and weight, to be effected through increased knowledge of the attenuation of gamma and neutron radiation in matter; development of an electrostatic generator to produce a highly accurate beam of monoenergetic neutrons; acceleration tubes in the design of a Van de Graaff accelerator; an experiment on geometric design for measuring the inelastic scattering of

fast neutrons; an outline of the instrument project program divided into sections for slow neutrons, fast neutrons, gamma radiation, area monitoring, high voltage supplies, and coincidence circuits; scintillation counters and coincidence circuits to be used in determining inelastic scattering cross sections for neutrons; nuclear resonance for magnetic field control; a spherical ionization chamber; and nuclear track plates.

5920 The Problem of Red Giants and Cepheid Variables. G. Gamow and C. Longmire. Phys. Rev. 79, 743-4 (1950) Aug. 15 (Letter to the editor).

According to the shell source model of star evolution, a star consists of an isothermal de-hydrogenized core with the carbon cycle taking place at the boundary between this isothermal region and hydrogen-rich layers, so that further evolution will consist in a gradual advance of the shell source into the virgin material and the corresponding growth of the central isothermal core. However, no solutions exist which correspond to an equilibrium condition of the star when the amount of material in the isothermal core exceeds 10% of the total mass. The authors point out that although the models with larger cores allow no static solutions, they permit some oscillatory solutions with finite amplitude. The main effect of the oscillation seems to be to let radiation flow more easily into the envelope, raising the temperature and pressure, and consequently pushing some of the mass into a region of weaker gravitational attraction. It is concluded that an oscillating shell-source star can be stable on the average when its depletion of hydrogen exceeds the maximum amount for a static star, although the perturbation method used by the authors does not allow them to say how far the depletion can be raised over the maximum for the static case. The above picture may present a possibility for understanding the pulsating properties of cepheid variables. There is also a chance that the above-described oscillations may ultimately become unstable and develop into periodic explosions in which large amounts of nuclear energy are liberated in every cycle.

5921 Production of Positive Mesons by Photons on Hydrogen. A. S. Bishop, J. Steinberger, and Leslie J. Cook. UCRL-774, June 26, 1950. 9p.

Liquid hydrogen was irradiated with photons, produced in the Berkeley synchrotron, with a bremsstrahlung spectrum of 330-Mev maximum energy. Both meson range and angle of production with respect to the beam were measured. The energy of the meson was computed by means of the range energy relation, and that of the responsible photon by the conservation laws. It was possible, therefore, to measure cross sections as a function of photon energy, despite the continuous character of the x-ray spectrum. The cross section for meson production, at 90 deg in the laboratory system, as a function of energy is shown. The angular distribution shows clearly that photomeson production is not a dipole photoeffect, as predicted by scalar meson theory, but that the interaction of the nuclear spin with the photon must play an important role.

5922 Cascades of Nuclear Disintegrations Induced by the Cosmic Radiation. G. Cocconi, V. Cocconi Tongiorgi, and M. Widgoff. Phys. Rev. 79, 768-80(1950) Sept. 1.

Energetic nuclear disintegrations induced by the N-component of cosmic radiation have been studied by detection of the moderate-energy neutrons released in the disintegrations themselves. The pulses of the neutron counters appeared on the sweep of a cathode-ray tube. A hodoscope of neon bulbs connected to an arrangement of G-M counters was simultaneously used to study the relative number of neutral and charged primaries and the penetration of the ionizing particles produced in the disintegrations. Lifetime, angular distribution, and average energy of the neutrons have been investigated. The multiplicities of the neutrons produced in absorbers of different thickness and material have been determined. Evidence has been derived of the existence of conspicuous cascades of nuclear disintegrations. A tentative analysis of the nuclear cascade process is given. (auth)

5923 Cosmic Rays Underground. C. M. Garelli and G. Wataghin. Phys. Rev. 79, 718-9(1950) Aug. 15 (Letter to the editor).

Results of calculations of the absorption of π and μ mesons underground are reported, taking into account the creation of π mesons by direct electromagnetic interaction of charged incident mesons with nuclei. The supplementary energy losses become more important than pair production and bremsstrahlung for energies >100 Bev. Therefore, these losses must be taken into account for mesons reaching great depths. Two extreme cases are considered: (1) negligible nuclear absorption for high energy π mesons; and (2) strong nuclear absorption. Starting from known experimental and theoretical data on the spectrum of π and μ mesons at sea level, calculations were performed taking into account the energy losses by ionization, decay, bremsstrahlung, electron pair production, and π meson production. Agreement with experiment is obtained for only the first case.

5924 The Density Spectrum and Structure of Extensive Cosmic-ray Air Showers at Sea Level. D. Broadbent, E. W. Kellermann, and M. A. Hakeem. Proc. Phys. Soc. (London) 63A, 864-83(1950) Aug. 1.

Showers have been examined in the density range 5 to 500 particles/m^2 using two trays of Geiger counters spaced horizontally 5 m apart, the discharges of individual counters being recorded using neon lamps. The observed showers are compared with a theoretical analysis based on the usual assumptions that the incident densities are uniform over the extent of the apparatus and distributed according to the spectrum $N(x) = Bx^{-\gamma}/hr/m^2$. The comparison shows (1) that in the density range examined the above spectrum applies only for a vanishingly small area of observation, with $\gamma = 1.425 \pm 0.022$, B = 620, and with no evidence for a change of γ with density, and (2) that for the separation of 5 m employed, the density cannot be regarded as uniform over the extent of the apparatus. It is shown that this second conclusion can lead to the explanation of many of the differences found between the results of other authors obtained on the assumption of uniformity of density; in particular, it is concluded that there is yet no significant evidence for a change of γ with altitude. (auth)

5925 A Directional and Latitude Survey of Cosmic Rays at High Altitudes. J. R. Winckler, T. Stix, K. Dwight, and R. Sabin. Phys. Rev. 79, 656-69(1950) Aug. 15.

The directional distribution of cosmic rays at atmospheric depths of 15 to 25 g/cm^2 has been measured with large counter telescopes carried by constant-level plastic balloons at geomagnetic latitudes of 0, 20, 30, and 40 deg. From the vertical flux measurements an energy spectrum for primary

PHYSICS

protons is obtained which has the form $N(E) = 0.27/E^{1.9}$, where N(E) is the number of particles in unit energy range at the energy E. The corresponding formula for primaries consisting entirely of alpha particles is $N(E) = 0.32/E^{1.81}$. The power law can be fitted between about 1 and 14 Bev, but there is good evidence that the spectrum flattens out below 1 Bev and becomes steeper at high energies. The total incident energy calculated under the assumption that the measured flux at 15 g/cm^2 consists of primaries is two times greater than the total incident energy appearing as atmospheric ionization. The east-west asymmetry values reach a maximum of 0.53 ± 0.05 at the equator and decrease to 0.24 ± 0.09 at 40 deg geomagnetic latitude. The asymmetry to be expected from the latitude effect if all primaries are positive reaches 1.20 at the equator, and at all latitudes and zenith angles is considerably higher than the observed asymmetry. It is not possible to decide on the basis of the present experiments whether this discrepancy arises from atmospheric effects or from a sizable fraction of negative primaries. 20 references. (auth)

5926 Experiments on Cosmic-Ray Mesons and Protons at Several Altitudes and Latitudes. Marcello Conversi. Phys. Rev. 79, 749-67(1950) Sept. 1.

Experiments to obtain further information about the meson component and the nucleonic component present in the atmosphere have been carried out near sea level, and in aircraft at different altitudes and latitudes, using G-M counters simultaneously in delayed coincidence and in anticoincidence. A summary of the results obtained is given. 70 references. (auth)

5927 Instrument for Directional Studies of Cosmic-Ray Intensity. H. W. Boehmer and J. E. Coolidge. Rev. Sci. Instruments 21, 633-8(1950) July.

In order to obtain a versatile instrument for directional cosmic ray studies, and to investigate an indicated correlation of the soft component of cosmic radiation with the present cosmic-ray burst studies being carried on at the University of Colorado a dual cosmic-ray telescope was constructed. Each bank of the telescope consists of five counter trays with nine Geiger counters in each tray. The electronic circuits are connected to give three triple consecutive coincidence trains: 1,2, and 3; 2,3, and 4; and 3,4, and 5. By the insertion of eight centimeter-thick lead blocks covering the sensitive area of a Geiger tray between trays 3 and 4, and 4 and 5, a separation of the components of the radiation is possible. The telescope is adjustable in zenith in 15-deg intervals from 0 to 75 deg from the vertical. However, in azimuth, in order to investigate asymmetry characteristics, two positions 180 deg apart are employed. The control of the telescope is entirely automatic with the recording of data being obtained by means of periodic photographs of the indicating panel, showing the counting rate, zenith and azimuthal positions, and the time and date of the measurement. The telescope changes in zenith and in azimuth every 40 min; the changes in zenith and azimuth being displaced 20 min. A cycle of operation, which consists of the step change in zenith from 0 to 75 deg with the associated alternate azimuthal changes, requires 4 hr. (auth)

5928 Intensity and Lateral Distribution of the N-Component in the Extensive Showers of Cosmic Radiation. G. Cocconi and V. Cocconi Tongiorgi. Phys. Rev. 79, 730-2(1950) Aug. 15 (Letter to the editor).

A study was made at Echo Lake, Col., 3260 m elevation, of the intensity and lateral distribution of the N-component (all particles capable of producing nuclear disintegrations such as high energy neutrons and protons, π mesons, etc) present in extensive air showers. A description of the apparatus is given. Although the statistical error is large, several conclusions regarding the density of the N-component relative to all ionizing particles present and regarding the origin of the N-component are drawn.

5929 Narrow Air Showers of Cosmic Rays. II. Absorption Measurements. J. P. N. Wei. Phys. Rev. 79, 670-3 (1950) Aug. 15.

The absorption of narrow air showers in Pb, Fe, and Al has been measured at sea level. Results indicate that there are two components in these narrow air showers, a soft component which consists of electrons and a hard component which consists of μ mesons. The soft component is practically completely absorbed in 4 in. of lead, whereas the hard component is not appreciably absorbed in 8½ in. of lead. A wooden roof of only 1 g cm^{-2} produces many local showers, which are nevertheless totally absorbed in a very thin layer of material. (auth)

5930 A Note on the Size-Frequency Distribution of Penetrating Showers. Alladi Ramakrishnan. Proc. Phys. Soc. (London) 63A, 861-3(1950) Aug. 1.

Heitler and Jánossy (Proc. Phys. Soc. (London) 62A, 669 (1949)) have calculated the probability of a given number of mesons being produced due to nucleon-nucleon collisions by a fast nucleon in its passage through matter of a given thickness. In this note the results of Heitler and Jánossy are obtained by the direct method of writing the integro-differential equations of the problem using the Markoff nature of the process. (auth)

5931 On the Particles Initiating High Energy Penetrating Showers. M. B. Gottlieb, A. J. Hartzler, and Marcel Schein. Phys. Rev. 79, 741-2(1950) Aug. 15 (Letter to the editor).

A cloud chamber was used to study high energy penetrating showers initiated by ionizing or nonionizing incident particles at Climax, Colorado (alt 11,500 ft). Counters were located below and across the center of the chamber. An examination of 73 selected events originating above the counters in the chamber disclosed that the high energy events were initiated predominantly by ionizing particles with an energy above 10^{10} ev. Assuming that they were primary protons, the vertical flux of protons at the top of the atmosphere of energy greater than 10^{10} ev is calculated. Penetrating showers initiated by π mesons produced in the last mean free path above the apparatus are discussed.

5932 Relation Between π^- and μ^- Meson Production Spectra in the Atmosphere. Giulio Ascoli. Phys. Rev. 79, 812-4(1950) Sept. 1.

A method of obtaining the parent π^- meson energy spectrum from the μ^- meson spectrum is presented and the relation of the two spectra is discussed. It is concluded that the μ^- meson spectrum must be rather smooth even if the parent spectrum is not. (auth)

PHYSICS

5933 Schwinger Potential in Nuclear Forces. F. C. Barker. Proc. Phys. Soc. (London) 63A, 898-909 (1950) Aug. 1.

The properties of the potential derived from the mixed pseudoscalar–vector meson field are investigated and compared with the experimental data on the two-nucleon system. An attempt has been made to use methods which are more accurate than those formerly applied to this problem, and some of these may be useful in calculations with other potentials. It is found that agreement with experiment cannot be obtained for any choice of meson masses and coupling constants. 24 references. (auth)

5934 Transition Effect of Extensive and Local Penetrating Cosmic-ray Showers in Colombo. V. Appapillai and A. W. Mailvaganam. Proc. Phys. Soc. (London) 63A, 856-61(1950) Aug. 1.

An account is given of experiments on the transition effects of local and extensive penetrating cosmic-ray showers at Colombo (geomagnetic latitude 4 deg S.). A comparison of the present results with those reported for higher latitudes indicates that there is no observable latitude effect of the local penetrating showers. Contrary to the findings of Broadbent and Jánossy (Proc. Roy. Soc. (London) 190A, 497(1947)) the transition effect of the extensive showers in paraffin appears comparable in magnitude with the effect in lead. (auth)

5935 Rotating Mirror Camera Design. Berlyn Brixner and Albert J. Lipinski. LA-1122, June 1, 1950. 27p.

The principles and a detailed description of a cylindrical film-plane rotating mirror camera are presented. A cross section of the general arrangement of such a camera is shown. A lens images an object on a film after reflection by a rotating mirror. The locus of the points of sharpest focus is a circle when the mirror plane passes through the axis of rotation and the image writing speed is constant. It is impractical to apply this condition to mirrors used at high rotational speeds because of balancing requirements. A thick symmetrical mirror construction is usually used and this separates the mirror plane from the axis of rotation. The locus of sharp focus is then a limacon, and the image writing speed becomes variable. Steps used in making calculations for the design of an all-metal Bowen camera are included.

5936 New Type of Electrostatic High-Voltage Generator. Peter W. Forsbergh, Jr. Office of Naval Research, London Branch. Technical Report No. ORNL-61-50, June 26, 1950. 4p.

A machine is described which consists of two rotary variable condensers driven on the same shaft by motor or hand crank. Mutual excitation of the two condensers enables the voltage level in the machine to rise to values limited only by high voltage breakdown in the pressurized chamber. Machines have been built up to 25 kw and 200 kv. Designs for one half to one million volts are under way. The efficiencies are 80% or more. For the smaller models the hand drive allows an exceptionally light, compact, and rugged machine. Fluctuations in hand speed are reflected in output power and not in output voltage.

5937 Observations on Some Properties of Ultra-High Frequency Gas Discharges. Charles F. Robinson. Rev. Sci. Instruments 21, 617-21(1950) July.

PHYSICS

A series of experiments designed to yield information on the mechanisms of ultra-high frequency discharges which influence the operation of ion sources employing such discharges is described. The main conclusions are that such discharges exhibit a high negative space charge due principally to secondary emission from the walls of the discharge chamber, that ion production is inhibited by the space-charge trap so formed, that under certain conditions extremely intense electron beams may be obtained from a resonant cavity containing a gas discharge, and that fairly large ion currents may be obtained by the interaction of the emergent gas and the emergent electron beam in the exit orifice of the cavity. (auth)

5938 Radioactive Isotope the Basis of New Textile Measuring Instrument. Textile Recorder, 1950, 81. July.

An instrument, utilizing a β-emitting isotope, which monitors the thickness or weight of laps, slivers, and rovings in textile manufacture is briefly described. The material is passed between the source and an ionization chamber.

5939 Radioactivity Slide Rule. Natl. Bur. Standards (U. S.) Tech. News Bull. 34, 111(1950) Aug.

A special slide rule for radioactivity measurements has been designed by representing graphically the relationship expressed in the conventional decay-correction formula. The slide rule greatly facilitates computation of radioactivity decay factors.

5940 Isotope Effect in Superconductivity. Natl. Bur. Standards (U. S.) Tech. News Bull. 34, 89-91(1950) July.

Transition temperatures at which different isotopes of the same element become superconducting have been investigated to determine whether the mass of the atomic nucleus has any effect on this temperature. The critical field was measured as a function of temperature in the neighborhood of the normal, or zero-field, transition temperature. By extrapolating to zero field, the normal transition temperature was accurately determined. It was found that pure Hg^{198} has a zero-field transition temperature of 4.177°K as compared with 4.156°K for natural mercury.

5941 Thermal Diffusion in the Critical Region. II. E. B. Giller, R. B. Duffield, and H. G. Drickamer. J. Chem. Phys. 18, 1027-30(1950) Aug.

The previous measurements (J. Chem. Phys. 18, 950(1950)) on thermal diffusion in the critical region for the system ethane-xenon are extended and completed, with the use of a modified Xe tracer technique. A rough calculation of cluster size in the critical region is made. A mechanism of molecular motion in the dense gas above the critical point, consistent with the data, is presented. It is shown that the transformation between dense gas and liquid occurs without discontinuity as far as thermal diffusion is concerned. The thermal diffusion columns operated in the region of turbulent heat transfer gave a separation as predicted by the modified theory of the column. (auth)

5942 Thermal Diffusion in the System Methane-Xenon. L. H. Tung and H. G. Drickamer. J. Chem. Phys. 18, 1031(1950) Aug.

PHYSICS

Thermal diffusion measurements have been carried out for the system methane-xenon at a temperature 100°C above the critical using two thermal diffusion columns and a radioactive Xe tracer technique (J. Chem. Phys. 18, 945, 950, 1027(1950)). The results confirm the column theory and are consistent with the results obtained on the system ethane-xenon.

5943 A Mass Spectrometric Investigation of Branching in Cu^{64}, Br^{80}, Br^{82}, and I^{128}. John H. Reynolds. Phys. Rev. 79, 789-94(1950) Sept. 1.

An investigation of branching in certain neutron induced activities has been carried out by a mass spectrometric technique. Gram quantities of the elements in question were subjected to prolonged irradiation in a graphite moderated pile and were allowed to cool. The occurrence of negatron emission in the induced activities was identified with the presence in the irradiated sample of decay products of atomic number $Z + 1$ and the occurrence of positron emission and orbital electron capture with the presence of decay products of atomic number $Z - 1$. The amounts of these decay products were determined by adding to a solution of the irradiated sample, as tracers, weighed milligram amounts of the daughter elements in a form isotopically different from the radiogenic material. When isotopic mixing had occurred, the daughter elements were isolated for mass spectrometric analysis. In such a procedure, quantitative recovery is unnecessary: the branching ratio can be determined from the change in the isotopic constitution of the tracers. The following values of the branching ratio $\lambda_{\pm}$ (defined as the ratio of $Z \rightarrow Z - 1$ transitions to $Z \rightarrow Z + 1$ transitions) were determined: Cu^{64} 1.62 ± 0.11; Br^{80} 0.090 ± 0.002; $Br^{82} < 0.00027$; I^{128} 0.053 ± 0.002. In addition, the following neutron absorption cross section ratios were evaluated. For moderated pile neutrons:

$$\frac{\sigma_a(Cu^{63})}{\sigma_a(Cu^{65})} = 2.32 \pm 0.11; \quad \frac{\sigma_a(Br^{79})}{\sigma_a(Br^{81})} = 3.86 \pm 0.05$$

20 references. (auth)

5944 Coincidence Circuit for a Scintillation Detector of Radiation. W. C. Elmore. Rev. Sci. Instruments 21, 649-52(1950) July.

A very simple low level coincidence circuit of moderate speed, which is suitable for use with two or more multiplier phototubes in a scintillation detector of radiation, is described. The operation of the circuit is analyzed, and performance data given to show its effectiveness in eliminating spurious counts due to noise pulses in the phototubes. Some useful modifications of the circuit are suggested. (auth)

5945 The Collimation of Nuclear Particles for Energy Measurements in Pulse Ionization Chambers and Proportional Counters. J. Howlett and W. J. Whitehouse. Atomic Energy Research Establishment Report No. AERE-N/R-473, Jan. 21, 1950. 9p.

Calculations have been made on the effects of a collimator, consisting of a perforated sheet, upon particles emerging in all directions from a thin film of material. The calculations include (a) the proportion of particles escaping through the collimator, (b) the distribution of the particles as a function of their path lengths in the film in which they originated, and (c) the average energy loss of the particles, over a restricted range in terms of the energy lost in passing perpendicularly

PHYSICS

through the film. The conclusion is reached that, in those experiments in which the statistical errors due to counting are predominant, it is usually better in practice to use a thin film without collimation than a thicker film with collimation. (auth)

5946 Decay Time and Efficiency of a Liquid Scintillator. R. F. Post. Phys. Rev. 79, 735(1950) Aug. 15 (Letter to the editor).

The fluorescence decay time and efficiency for fast counting of a liquid scintillator has been investigated, using a pulsed counter technique previously described by R. F. Post et al (Phys. Rev. 78, 81(1950)). The liquid studied was a saturated solution of terphenyl (p-diphenylbenzene) in toluene. Toluene was chosen as the solvent in preference to xylene because of its simple structure. To obtain the decay time several photographs of count pulses from a Ag^{110} source immersed in the liquid were analyzed. The value and rms deviation found for the decay time (for decay 1/e) at room temperature was: $1/\lambda = 2.2 \pm 0.3 \times 10^{-9}$ sec. The observed rise times (10 to 90%) ranged between 6 and 10×10^{-10} sec, so that the error made in neglecting the finite rise time in the measurements is probably small. Using an oscilloscope method, a measurement was made of maximum pulse heights obtained from the liquid scintillator, and also those obtained from a stilbene crystal of comparable size and shape. In the setup employed it was found that the maximum pulse heights obtainable from the liquid were up to 30% greater than those from stilbene. These results are of course peculiar to the particular optical geometry employed. Although it can be inferred from the relative decay times of stilbene and the toluene-terphenyl solution that the total number of photons per unit energy of excitation may be smaller in the case of the liquid, the maximum absolute rate of photon emission appears to be higher for the liquid.

5947 Duration of Scintillations from Organic Phosphors. J. O. Elliot, S. H. Liebson, R. D. Myers, and C. F. Ravilious. Rev. Sci. Instruments 21, 631-3(1950) July.

Measurements have been made on the time of decay of scintillations from organic phosphors irradiated with γ rays. Interference between the output pulse from a photomultiplier and its reflection from a shorted line is used to determine the time constants. (auth)

5948 Energy Dependence of the Naphthalene Scintillation Detector. Jack C. Smeltzer. Rev. Sci. Instruments 21, 669(1950) July (Laboratory note).

Measurements of the sensitivity of a naphthalene scintillation detector for x-rays with energies of 250 to 1200 kev show that the ratio

$$S = \frac{\text{d-c current out of photomultiplier in } \mu a}{\text{intensity of radiation in r/min}} \simeq 1.8$$

is essentially independent of energy and intensity in this region. The experimental data given show that S varied less than 1.5% for constant irradiation with variable energy. A companion experiment showed less than 2% variation for tenfold variation of intensity at constant effective energy of 500 kev.

5949 The Era of Geiger Counters. Leslie M. Norman. Radio and Television News 44, 34-35, 137(1950) July.

PHYSICS

A review of commercially-built instruments for the detection of radioactive materials is presented.

5950 Fluorescence of Solutions Bombarded with High Energy Radiation (Energy Transport in Liquids). Hartmut Kallman and Milton Furst. Phys. Rev. 79, 857-70(1950) Sept. 1.

It is experimentally shown that solutions bombarded with high energy radiation exhibit strong fluorescence when only small amounts of "fluorescent molecules" are added to the solvent. The same amount of fluorescent substance alone would give only about 0.01 of the observed light emission. The large emission in the solution is explained by a transport of excitation energy from the solvent to the fluorescent molecules. An analysis of the mechanism of energy transport in the liquid is also given. (auth)

5951 Gamma- and Beta-Ray Spectroscopy with Proportional Counters in Magnetic Fields. S. C. Curran, A. L. Cockroft, and G. M. Insch. Proc. Phys. Soc. (London) 63A, 845-7(1950) Aug. 1.

Proportional counters operating in a "condensing" type of magnetic field can be used as β- or γ-ray spectrometers up to at least 2 Mev. Trial histograms for P^{32} and annihilation γ radiation are shown. (auth)

5952 The Measurement of Proton Energies with Scintillation Counters. W. Franzen, R. W. Peelle, and R. Sherr. Princeton Univ. Technical Report No. 1, nd. 15p. (AEC File No. NP-1656.)

The response of anthracene and KI(Tl) and NaI(Tl) crystals to protons of varying energies (up to 16.9 Mev) was measured. The response to protons was compared with that of Cs^{137} conversion electrons and polonium α particles. NaI crystals seem to be the most desirable although a difficulty arises because of its affinity to water vapor.

5953 A Probe-type Direct-reading Dosage-rate Meter. R. C. Turner and S. P. Newbery. Brit. J. Radiology 23, 424-9(1950) July.

A direct-reading probe-type dosage-rate meter suitable for radium or x-ray measurements inside the human body is described. The instrument utilizes an "air-walled" chamber of 0.07-cc volume together with a miniature thermionic electrometer system, the whole comprising a probe which may be shaped to specific requirement and be readily capable of insertion into the major body cavities. The electrometer output is conveyed by a flexible multicored cable of any desired length to the amplifying and indicating system which may be housed at any convenient distance. The most sensitive range of the instrument gives full-scale deflection for 5 r/min, but the sensitivity is easily adjustable from this figure up to several hundred roentgens per minute if required. Standard components are used throughout, the electrometer system being comprised of miniature radio valves. Some clinical uses to which the instrument has already been put are described. (auth)

5954 Scintillations in Liquids and Solutions. M. Ageno, M. Chiozzotto, and R. Querzoli. Phys. Rev. 79, 720 (1950) Aug. 15 (Letter to the editor).

The fluorescing power of a number of liquids irradiated with γ rays from ThC'' was examined. It was found that pure liquids responded poorly while higher fluorescing power was shown by certain solutions. Small amounts of naphthalene in xylene increased the fluorescing power greatly but saturation occurred at higher concentrations. The reason for this increase is discussed.

5955 Spectral Emission from Scintillation Solutions and Crystals. F. B. Harrison and G. T. Reynolds. Phys. Rev. 79, 732(1950) Aug. 15 (Letter to the editor).

The emission spectra of crystalline terphenyl, solutions of terphenyl in benzene, xylene, and toluene, an anthracene crystal, and a solution of anthracene in xylene are illustrated. Excitation was effected by 50-kv x-rays or the ultraviolet Hg 2537A line, the resulting spectra appearing to be the same.

5956 Temperature Characteristics of Naphthalene-Anthracene Mixtures. S. H. Liebson and R. T. Farrar. Phys. Rev. 79, 733(1950) Aug. 15 (Letter to the editor).

In order to clarify the energy transfer mechanism in organic scintillators, the variation of light output under γ excitation of a series of phosphors containing known amounts of anthracene in naphthalene was determined. A Wratten Type IIA filter to exclude naphthalene light was used. As the percentage of anthracene is reduced, the temperature characteristics assume a greater slope, similar to the characteristics of pure naphthalene. On the other hand, as the percentage of anthracene is increased the characteristics become less temperature dependent and have a smaller slope at the lower temperatures than does anthracene itself. This was further verified with mixtures containing greater percentages of anthracene. The measurements suggest that the temperature characteristics for these materials are determined by the matrix (naphthalene) crystal, the larger percentages of anthracene corresponding to shorter paths for energy transfer and less thermal quenching.

5957 Behavior of Stack Gases in Still Air. A. F. Rupp, S. E. Beall, L. P. Bornwasser, and D. H. Johnson. AECD-2909, Apr. 12, 1944. Decl. Aug. 2, 1950. 28p.

Theory and experiments are adduced which show that a stack discharging air vertically upward into still air at stack air temperature produces a cone-shaped body of moving air above the stack. The radius of this cone is shown to be, at height h, $R = r_s + 0.15\ h$, where r_s = stack radius, and h = distance above top of stack. Its velocity is $V = V_s\left(\frac{r_s}{r_s + 0.15\ h}\right)$ where V_s = stack air velocity, and the concentration of a contaminant in it is $C = C_s\left(\frac{r_s}{r_s + 0.15\ h}\right)$ where C_s = stack concentration. These rules seem to break down for stacks less than about 2 in. in diameter, and have been tested only up to 8 in. diameters. (auth)

5958 Atmospheric Pollution. Louis C. McCabe. Ind. Eng. Chem. 42, 123-4A (1950) Sept.

Progress in the work, from 1915 to date, on distribution of atmospheric contaminants is briefly reviewed. 18 references.

5959 Fast Neutron Data. H. Feshbach. AECD-2904, Jan. 25, 1950. Decl. Aug. 29, 1950. 96p.

This report is concerned with "fast" neutrons, i.e., neutrons whose energy lies between 200 kev and several million electron volts. It includes a compilation and dis-

cussion of the available data on substances of interest for the shielding problem. The results of a schematic treatment of the behavior of neutron cross-sections with energy is given and thus provides a method for analyzing the available data and for interpolating and extrapolating for those energy ranges and substances for which data is not available.

5960 Neutron-Deuteron Scattering at 4.5 and 5.5 Mev. Ernest Wantuch. Phys. Rev. 79, 729-30(1950) Aug. 15 (Letter to the editor). (See also NSA 4-3792.)

The angular distribution and differential cross section of 4.5- and 5.5-Mev neutrons scattered by deuterons were investigated. The source of neutrons for this investigation was the D + D → n + He^3 + 3.26-Mev reaction. Neutrons emitted in the forward direction within a cone of 3 deg half-angle, having a calculated energy spread of ±100 kev, were incident on the scatterer. The scattering material was deuterium gas at atmospheric pressure or a 0.001-in. layer of heavy paraffin. Recoil deuterons ejected from the scatterer were detected by a twofold-coincidence proportional counter telescope. The and Massey (Proc. Roy. Soc. (London) 179A, 123(1941)). Their calculations of the scattering phases in the region 0 to 11.5 Mev were interpolated for the energies used. The total cross sections, if one assumes a reasonable extrapolation to the angles where no experimental data could be obtained, are in acceptable agreement with experimental total cross sections obtained by Nuckolls et al., (Phys. Rev. 70, 805(1946)). The ratio of the differential cross section at 180 deg to the value at the minimum is approximately 5:1 at both energies. This is much larger than the ratio (2:1) predicted by the exchange force theory.

5961 The Spin of the Neutron. M. Hammermesh and E. Eisner. Phys. Rev. 79, 888(1950) Sept. 1 (Letter to the editor).

The spin value ½ for the neutron is based mainly on the ortho-para hydrogen scattering discussed by Schwinger (Phys. Rev. 52, 1250(1937)). This evidence (and other evidence from purely nuclear experiments) can be objected to on the ground that it involves nuclear theory and is not sufficiently direct. Hughes et al., (Phys. Rev. 76, 1413(1949)) have studied the reflection of neutrons from magnetized iron mirrors, the equivalent of the Stern-Gerlach experiment for neutrons. The spin value ½, and not ⅔, fits the data on the critical angles of total reflection.

5962 Thick Target Fast Neutron Yield from 15-Mev Deuteron and 30-Mev Alpha Bombardment. A. J. Allen, J. F. Nechaj, K. H. Sun, and B. Jennings. Westinghouse Research Laboratories. Mar. 9, 1950. 33p. (AEC File No. NP-1507.)

The total yield and angular distribution of fast neutrons from bombardment of thick targets of pure Be, Al, Ti, Cr, Mn, Co, Cb, Mo, Ag, Cd, Ta, Au, Pb, and Bi by 15-Mev deuterons and 30-Mev alpha particles was measured. These studies were made using the reaction $S^{32}(n,p)P^{32}$ as a threshold detector and using fission ionization chambers. The total neutron yield per second per μa of the cyclotron beam, N, was observed to decrease with increase in nuclear charge, Z, of the target according to the approximate empirical equations, log N = 10.18 − 0.0234Z for deuteron bombardment and log N = 9.68 − 0.0234Z for alpha. In all cases studied, the angular distribution of fast neutrons from target bombarded by deuterons showed a pronounced peak in the yield

in the forward direction. Some measurements are also reported in the slow neutron yield from the Be target. 14 references. (auth)

5963 The Binding Energies of the Triton and the Alpha Particle. Atomic Energy Research Establishment. Report AERE-Inf/Bib-67, July 1, 1950. 4p.

This bibliography was compiled from Chemical Abstracts 1932 to May 1950, Nuclear Science Abstracts July 1948 to May 1950, and Science Abstracts A 1932 to May 1950.

5964 Energy Levels in C^{12} from $Be^9(\alpha,n)C^{12}$. William H. Guier and James H. Roberts. Phys. Rev. 79, 719-20 (1950) Aug. 15 (Letter to the editor).

The neutron energy spectrum from the $Be^9(\alpha,n)C^{12}$ reaction using a thin Po alpha-source and thin Be target was measured by the proton recoil method in Kodak NTA nuclear emulsions. The highest energy group corresponding to a transition to the ground state of C^{12} was not analyzed since it contained only 9 tracks. The Q of the reaction for transition to the ground state used was 5.76 Mev. In addition to levels at 4.4 and 7.1 Mev previously reported, one at 7.9 ± 0.5 Mev was found.

5965 The Excited Nuclear State of Be^7. George D. Freier, T. F. Stratton, and L. Rosen. Phys. Rev. 79, 721-2 (1950) Aug. 15 (Letter to the editor).

A lithium target was bombarded with 3.49-Mev protons and the neutrons from the $Li^7(p,n)Be^7$ reaction were detected by measuring the proton recoils in Ilford G5 and C2 emulsions. Two neutron groups were observed, one at 1.80 Mev corresponding to Be^7 in the ground state, and one at 1.34 Mev corresponding to Be^7 left in an excited state. Applying the correction for (n,p) cross section it was found that the ratio of Be^7 left in the excited state to that left in the ground state is 0.10 ± 0.03.

5966 Hyperfine Structure and Isotope Shift in Barium. O. H. Arroe. Phys. Rev. 79, 836-8(1950) Sept. 1.

Spectroscopic hyperfine structure studies with separated isotopes of barium have definitely confirmed a nuclear spin ½ for the odd isotopes Ba^{135} and Ba^{137}. The lines of the even isotopes show no structure. The isotope shift is linear among masses of the same parity, but there is a relatively great odd-even shift. The order is 138, 136, 134, 137, 135 in BaI, and 138, 136, 137, 134, 135 in BaII. The relative positions of the components (centroids, for odd masses) of the resonance lines, in units of 10^{-3} cm^{-1}, with uncertainties of $\pm 0.7 \times 10^{-3}$, are as follows:

	138	137	136	135	134
BaI $6s^2\ {}^1S_0 - 6s6p\ {}^1P_{1/2}$	0	5.2	2.2	7.4	4.4
BaII $6s\ {}^2S_{1/2} - 6p\ {}^2P_{1/2}$	0	6.0	4.8	11.1	9.6
$6s\ {}^2S_{1/2} - 6p\ {}^2P_{3/2}$	0	6.4	5.4	12.6	10.8

(auth)

5967 Hyperfine Structure and Nuclear Spin of Yttrium, $^{89}_{39}Y$. H. Kuhn and G. K. Woodgate. Proc. Phys. Soc. (London) 63A, 830-2(1950) Aug. 1.

By the use of a liquid air-cooled hollow-cathode tube with very low current densities it was possible to resolve hyperfine structure in the arc spectrum of yttrium. The value of the nuclear spin was found to be I = ½ and the sign of the magnetic moment to be negative. This agrees with recent

PHYSICS

results of Crawford and Olson (Phys. Rev. 76, 1528(1949)) who determined the nuclear spin from the intensity ratio of a hyperfine-structure doublet in the second spark spectrum of yttrium. (auth)

5968 Nuclear Electric Quadrupole Interactions in Crystals. R. V. Pound. Phys. Rev. 79, 685-702(1950) Aug. 15.

A study is made of the effects of the presence of nuclear electric quadrupole moments on the nuclear magnetic resonance absorption in solids. Necessary theoretical background is followed by descriptions of experiments in which the spectra obtained with an r-f spectrograph are found to show marked splitting resulting from the quadrupole interaction with the electric field gradient. Both powder patterns and spectra of single crystals are reported for Li^7, Na^{23}, and Al^{27}, with splittings varying from about 20-718 kc depending on the crystal and the nucleus. Unambiguous indication of the spin values is obtained. The possibility of the detection of a resonance resulting from the electric quadrupole splittings in the absence of a static magnetic field is discussed. An unsuccessful attempt to find such a resonance in ICl is described and the failure tentatively explained. Available signal-to-noise ratios are calculated for such resonances. A method is described for determining the frequency of a large electric quadrupole splitting, by observation of the dependence of the frequency of the magnetic splitting of the levels $m \pm \frac{1}{2}$, for an odd half-integral spin, on the angle between the direction of a magnetic field and the symmetry axis of the crystalline field. The electric quadrupole moment is shown probably to account for relaxation times of nuclei of spin greater than ½ even in cubic crystals and, as evidence, resonances of Na^{23}, Li^7, I^{127}, and Br^{81} are reported. Assuming partial saturation and electri electric quadrupolar relaxation, calculations are made to account for a departure of the intensity ratios of the lines, in the Na^{23} spectrum in $NaNO_3$, from the ratios of the transition probabilities for magnetic dipole radiation. The possibility of determining nuclear electric quadrupole moments from splittings or relaxation times in ionic crystals is discussed. 38 references. (auth)

5969 Nuclear Size Resonances. K. W. Ford and D. Bohm. Phys. Rev. 79, 745-6(1950) Aug. 15 (Letter to the editor).

Recent data on slow neutron scattering by nuclei have been examined to look for a possible regular variation of scattering amplitude with nuclear size, or with mass number A. The bound scattering amplitude (= scattering length) plotted vs. mass number gives some indication of such a regularity, but is by no means conclusive. If the neutron wave function is influenced in a regular manner by the nuclear size, the scattering amplitude vs. mass number curve should show resonances similar to those which appear when this quantity is plotted against neutron energy for a single element. Several illustrating cases are pointed out. Coherent scattering is also discussed from this viewpoint. Several models would predict qualitatively such resonance behavior, namely, (a) a square well (without absorption) with the well depth properly adjusted; (b) the liquid drop model; (c) and an energy level varying in a regular way (decreasing with increasing A). There is, however, no theoretical justification for (c).

5970 On the Lower Levels of He^5. Herbert Goldstein. Phys. Rev. 79, 740(1950) Aug. 15 (Letter to the editor).

PHYSICS

An inverted P doublet in which the $P_{\frac{1}{2}}$ level lies above the observed energy range is proposed for a level scheme for He^5. From the measured $P_{\frac{1}{2}}$ phase shift it can be estimated that the separation of the doublet must be between 2 and 5 Mev. This level scheme is consistent, on the whole, with neutron scattering measurements and, therefore, is probably also the correct one for the mirror nucleus Li^5. Although the levels of the doublet are quite wide, the separation is so large that the upper $P_{\frac{1}{2}}$ level can have little influence on phenomena occurring in the neighborhood of the $P_{\frac{3}{2}}$ resonance. On this model it should, therefore, be possible to explain the observations below 1.6 Mev in terms of a single $P_{\frac{3}{2}}$ level, plus, of course, an S potential scattering. Destructive interference takes place between the S potential scattering and the $P_{\frac{3}{2}}$ resonance above the position of the level. In forward scattering the interference is constructive above the resonance and destructive below the resonance. Hence one should expect a progressive shift from predominantly backward scattering at low energies to very pronounced forward scattering above the $P_{\frac{3}{2}}$ level, and this is exactly what is observed. More measurements in the region above 2 Mev, especially angular distributions, would appear to be highly desirable in order to determine accurately the splitting of the P doublet.

5971 The Radiofrequency Spectrum of $K^{39}F$ by the Electric Resonance Method. Ludwig Grabner and Vernon Hughes. Phys. Rev. 79, 819-28(1950) Sept. 1.

The molecular beam electric resonance method has been used to investigate the rotational Stark spectrum of $K^{39}F$. In this method linear polar diatomic molecules in one, or at most two, rotational states and definite states of space quantization are selected by means of inhomogeneous electric fields. The molecular transitions are not of the ΔJ type (transition between different rotational states). Rather, the transitions are between states with the same value of J but different values of m_J, the electric quantum number characterizing the state of space quantization. Lines are observed as a change in intensity of the refocused beam when the frequency of an oscillating field perpendicular to a homogeneous field, times Planck's constant, is equal to the energy difference between different states of space quantization. The frequency of the rotational Stark line is determined by the value of the homogeneous static field. The Stark line was observed at low and high fields for J = 1 and low fields for J = 2. It is found to be split. The fine structure is due to an interaction of the nuclear electric quadrupole moment of the K^{39} nucleus with the rest of the charges of the molecule, as well as a variation of $\mu^2 A$ with the vibrational state of the molecule, where μ is the permanent electric dipole moment, and A is the moment of inertia. In addition, the quadrupole interaction constant is found to vary with the variational state. It is measured when the molecule is in the rotational state J = 1 and the vibrational states v = 0,1,2,3,4; and J = 2, v = 0,1,2. The frequency dependence of the Stark line at strong fields permits the determination of μ and A; they were determined only for the zeroth vibrational state. The results are: For J = 1, v = 0, $eqQ/h = (-7.938 \pm 0.040)$ Mc/sec, where e = the charge of the proton, Q = nuclear electric quadrupole moment, $q = \partial^2 V/\partial z^2$ the second derivative of the electrostatic potential, due to all the charges outside the nucleus, taken along the axis of the molecule at the position of the nucleus. The absolute value of eqQ/h decreases about 1.3% when the vibrational quantum number

PHYSICS

increases by unity. Within experimental error the quadrupole interaction and its variation with vibrational state for J = 2 is the same as for J = 1. A complete tabulation of the results are included. For the zeroth vibrational state $\mu = (7.33 \pm 0.24)$ Debye, $A = (138.4 \pm 6.9) \times 10^{-40}$ g cm^2. From A, the internuclear distance for the zeroth vibrational state is r = (2.55 ± 0.0(0.06) angstroms. From the variation in intensity with vibrational state for a single transition the vibrational constant $\omega_0 = (390 \pm 39)$ cm^{-1}. (auth)

5972 Special and Magic Numbers as Factors in Nuclear Stability and Abundance. William D. Harkins. Phys. Rev. 79, 724-5(1950) Aug. 15 (Letter to the editor).

The strong correlation of nuclide abundance with even neutron or proton number and with magic numbers is emphasized.

5973 Photoneutron Thresholds of Beryllium and Deuterium. R. C. Mobley and R. A. Laubenstein. ANL-4468, June 8, 1950. 21p.

The photoneutron thresholds of beryllium and deuterium have been measured by comparison with the $Li^7(p,n)$ threshold. For this purpose an electrostatic generator was used in which an electron beam and a positive ion beam were established simultaneously. Accurate control and measurement of the generator voltage was obtained by using an electrostatic analyzer on the H_2^+ component of the ion beam. Because the $Li^7(p,n)$ threshold lies between the $Be^9(\gamma,n)$ and $D(\gamma,n)$ thresholds, errors in extrapolation should be small. The electron beam was accelerated from ground to the accurately known potential of the high voltage electrode where x-rays were produced for the photodisintegration process. From the photoneutron thresholds the neutron binding energies of beryllium and deuterium were found to be 1.666 ± 0.002 and 2.226 ± 0.003 Mev, respectively. (auth)

5974 Differential Cross Section of the Reaction $He^3(d,p)He^4$ at 10.2-Mev Bombarding Energy and Search for an Excited State in He^4. J. C. Allred. LA-981, Nov. 15, 1949. 153p.

The differential cross section from 17.5 to 162.5 deg at 2.5-deg intervals in the laboratory system for the $He^3(d,p)He^4$ reaction using 10.2-Mev deuterons and photographic plate detectors has been determined. The total cross section was estimated to be 43 mb ± 20%. A search for excited states was made by examining plates exposed at 90° in the lab system. An upper limit of 0.2 mb per unit solid angle was estimated for the $He^3(d,p)He^4$ reaction leaving He^4 in an excited state up to 20.9 Mev. 24 references.

5975 Carrier-Free Radioisotopes from Cyclotron Targets. XI. Preparation and Isolation of Os^{185} and $Re^{183,184}$ from Tungsten. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. UCRL-804, May 26, 1950. 4p.

The document is reproduced below in its entirety.

Long-lived radioisotopes (G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20, 585(1948)) of rhenium and osmium have been isolated in the carrier-free state from a tungsten exit strip which was removed from the 60-in cyclotron at Crocker Laboratory after a period of four months of almost continuous operation with protons (10 Mev), deuterons (20 Mev) and alpha particles (40 Mev). The possible transmutation reactions include: W(d,xn)Re, W(p,xn)Re, W(α,pxn)Re, and W(α,xn)Os. In the procedure reported here, the long-lived isotopes of rhenium, $Re^{183,184}$, and osmium, Os^{185}, produced by the nuclear reactions $W^{182}(d,n)Re^{183}$, $W^{183}(d,2n)Re^{183}$, $W^{183}(d,n)Re^{184}$, $W^{184}(d,2n)Re^{184}$, $W^{182}(\alpha,pn)Re^{184}$, $W^{182}(\alpha,n)Os^{185}$ and $W^{183}(\alpha,2n)Os^{185}$, were separated from the target element and from other possible long-lived transmutation products by a combination of volatility and solvent extraction methods.

The tungsten strip (~2 g) was fused with 10 g of KOH and 0.5 g of KNO_3 at 500°C for 30 min to form the water-soluble tungstate, perrhenate, and osmate. The fused mass was dissolved in a minimum volume of cold water and centrifuged to remove insoluble matter. The solution was acidified with 16N HNO_3, precipitating tungstic acid which was removed by centrifugation. The supernatant containing the carrier-free radio-rhenium and radio-osmium was diluted to 5N and transferred to an all-glass distilling flask. The carrier-free radio-osmium, presumably as the volatile OsO_4, was distilled into an ice-cooled trap containing 5N HNO_3. The rhenium activity remained in the residual solution. The HNO_3 distillate (25 ml) was extracted with two 25 ml aliquots of CCl_4 which removed over 95% of the radio-osmium from the aqueous phase. After washing with water to remove HNO_3, the radio-osmium was quantitatively re-extracted from the CCl_4 phase with 2 ml of 0.1N NaOH which on neutralization gave an isotonic saline solution for biological investigation. The carrier-free radio-rhenium was isolated from the residual HNO_3 solution using the distillation procedure previously described (J. D. Gile, W. M. Garrison, and J. G. Hamilton, J. Chem. Phys. 1950) in the preparation of carrier-free rhenium from tantalum. The Os^{185} was identified by the 97-day half-life and by the 0.75 Mev γ ray previously reported (L. I. Katzin and M. Pobereskin, Phys. Rev. 74, 264(1948) and L. J. Goodman and M. L. Pool, Phys. Rev. 71, 288(1947)). The $Re^{183,184}$ showed the 0.2 and 0.7-Mev β particles and the 1.0-Mev γ ray reported (G. Wilkinson and H. G. Hicks, Phys. Rev. 77, 314(1950)) for 50-day Re^{184}. Half-life measurements showed an ~57-day period which began to lengthen after 3 weeks because of the ~240-day Re^{183} isotope. The activities were further identified by chemical separation using W, Re, and Os carriers.

5976 The Angular Distribution of Protons from the Reaction $^{27}Al(d,p)^{28}Al$. J. R. Holt and C. T. Young. Proc. Phys. Soc. (London) 63A, 833-8(1950) Aug. 1.

Experiments are described in which a differential ionization chamber was used in the measurement of angular distributions of disintegration particles. Results are given for seven groups of protons from the (d,p) reaction with aluminum in which deuterons having energies of 4.6, 5.8, and 7.5 Mev were used. The distribution curves are of complicated form, with a general tendency for the protons to be emitted in the forward direction. (auth)

5977 The $^{11}B(\alpha,n)^{14}N$ Reaction. L. E. Beghian, M. A. Grace, and H. Halban. Proc. Phys. Soc. (London) 63A, 913-14(1950) Aug. 1 (Letter to the editor).

The bombardment of ^{11}B by α particles can lead to the emission of neutrons, protons, and γ rays. In an investigation of the neutrons and γ rays from these reactions, using polonium α particles of 5.3 Mev measurements were made of the energy spectrum of the emitted neutrons and the energy and intensity of the γ rays. The neutron spectrum is shown as calculated from the pulse height distribution, after cor-

PHYSICS

rections had been made for wall effect and the screening effect of positive ions in the chamber. The spectrum shows a broad maximum at 2.5 Mev in good agreement with the photographic plate measurements of Perlman, Richards, and Speak (MDDC-39, 1946), who used a target of natural boron (80% B^{11}, 20% B^{10}). The γ rays from the source were detected in a pair of thin-walled glass G-M counters set up in coincidence, with a Perspex converter in front of the first counter to produce the secondary electrons. The absolute sensitivity of this arrangement was measured with γ rays from Co^{60} and Na^{24}. From the shape of the γ-ray absorption curves it was possible to deduce the presence of one line of 2.2 ± 0.2 Mev; its intensity was 9% of the neutron flux and 2% of the polonium γ-ray flux. It is probable that these γ rays originate from an excited state of N^{14} formed by the $B^{11}(\alpha,n)$ reaction.

5978 Li^8 Splinters from Nuclear Bombardments. S. Courtenay Wright. Phys. Rev. 79, 838-45(1950) Sept. 1.

Li^8 has been produced by 340-Mev proton and 190-Mev deuteron bombardments of C, N, Ne, A, Kr, and Xe. The target element formed the gas of a proportional counter. The 0.88-second β decay of Li^8 produces Be^8 which disintegrates into two α particles with a half-life of 10^{-21} sec. Li^8 was detected by observation of these α particles and identified by its half-life. Deuteron excitation functions for the production of Li^8 are given for C, N, Ne, and A. In the case of 190-Mev deuterons the cross section varies from about 13×10^{-28} cm^2 for C to 4×10^{-29} cm^2 for Xe. For 340-Mev protons the variation is from about 7×10^{-28} cm^2 for C to 3×10^{-29} cm^2 for Xe. A discussion of the process involved is given. (auth)

5979 Neutron Cross Sections at 120 and 345 ev. C. T. Hibdon. Phys. Rev. 79, 747-8(1950) Sept. 1.

Total neutron cross sections of 19 elements have been measured by employing the neutron resonance scattering properties of cobalt and manganese. Thin foils of cobalt and manganese were used as neutron detectors at 120 and 345 ev, respectively. A semilogarithmic plot of neutron counts vs thickness of sample was made for each element for each of the two energies. An initial curvature in the plot indicated that the detector resonance overlapped a resonance in the element under study. The cross section determined from either a straight-line plot or the asymptotic part of a transmission curve was identified as either the potential scattering cross section, the off-resonance scattering cross section, or as the minimum cross section in the neighborhood of a resonance. (auth)

5980 The Neutrons from the Disintegration of C^{13} by Deuterons. C. E. Mandeville and C. P. Swann. Phys. Rev. 79, 787-8(1950) Sept. 1.

Nuclear energy levels in N^{14} are calculated from Q-values of neutron groups in the reaction $C^{13}(d,n)N^{14}$. Levels occur at 2.19 ± 0.07, 3.47 ± 0.07, and 4.90 ± 0.07 Mev. From a comparison with results of other measurements, it appears that several different nuclear reactions excite the same levels in N^{14}. (auth)

5981 The Neutrons from the Disintegration of the Separated Isotopes of Magnesium by Deuterons. C. P. Swann, C. E. Mandeville, and W. D. Whitehead. Phys. Rev. 79, 598-600(1950) Aug. 15.

When Mg^{25} is irradiated by 1.47-Mev deuterons, four groups of neutrons appear from which nuclear energy levels are deduced in Al^{26} at 2.00 ± 0.18, 3.63 ± 0.18, and 5.13 ± 0.18 Mev. The Q-value for the formation of Al^{26} in the ground state is 5.58 ± 0.10 Mev. From the disintegration data, the mass of Al^{26} is calculated to be 25.9935 ± 9×10^{-4} mass units. Bombardment of Mg^{26} by deuterons gives rise to eight groups of neutrons corresponding to energy levels in Al^{27} at 0.88 ± 0.07, 1.92 ± 0.07, 2.75 ± 0.07, 3.65 ± 0.07; 4.33 ± 0.07, 5.32 ± 0.07, and 5.81 ± 0.07 Mev. The Q-value for the formation of Al^{27} in the ground state is 5.68 ± 0.05 Mev. No quantitative analysis was made of the reaction $Mg^{24}(d,n)Al^{25}$. However, since Mg^{24} was the principal isotopic impurity, it was necessary to show that its presence made no contribution to the spectra of the two preceding reactions. Ilford C2 emulsions, making angles of 0 and 90 deg with the bombarding beam in the laboratory system of coordinate axes, were employed as detectors of the emergent neutrons. The track lengths of recoil protons making angles as great as 12 deg with the forward direction were accepted. From the track lengths, the neutron energies were deduced. (auth)

5982 A Note on Asymmetric Fission. T. Yasaki and O. Miyatake. Phys. Rev. 79, 740-1(1950) Aug. 15 (Letter to the editor).

An investigation on the mechanism of fission has been carried out on the assumption that the nucleus consists of two concentric spherical parts of different charge densities, with uniform mass density and a constant volume for all distortions. The compound nucleus U^{236} is assumed to have 27 protons and 50 neutrons in its inner part (core), whose radius is 69% of that of the nucleus, and its outer part to consist of 65 protons and 94 neutrons. The charge density is supposed to be uniform in each part. The extremum of the total kinetic energy of fragments, separated by twice the radius of the compound nucleus, occurs when the ratio of their masses is 3:2. The existence of the core is effective when the excitation energy is low, but it is less effective for high energy excitation. Thus, symmetric fission becomes more favorable when heavy nuclei are bombarded by fast particles.

5983 The Photodisintegrations $^6Li(\gamma,D)^4He$ and $^7Li(\gamma,T)^4He$. E. W. Titterton. Proc. Phys. Soc. (London) 63A, 915-17(1950) Aug. 1 (Letter to the editor).

Lithium-loaded Ilford E_1 emulsions of thickness 200 μ were irradiated with γ rays (14.8 and 17.6 Mev) from the reaction $Li^7(p,\gamma)Be^8$, Be^{8*}. The reaction $Li^7 + \gamma = He^4 + H^3 - 2.5$ Mev was observed in addition to numerous carbon stars. The cross section of the (γ,T) reaction was calculated from the $C^{12}(\gamma,3\alpha)$ cross section by observing the relative frequencies of the two types of event in the emulsion. It was (1.2 ± 0.6) × 10^{-28} cm^2. While the $Li^6 + \gamma = He^4 + H^2$ reaction was not observed, an upper limit to its cross section was calculated as (0.4 ± 0.4) × 10^{-28} cm^2.

5984 Photodisintegration of the Heavy Elements. R. W. Parsons and C. H. Collie. Proc. Phys. Soc. (London) 63A, 839-44(1950) Aug. 1.

The photothresholds for the emission of neutrons by the following elements have been determined; the threshold in

PHYSICS

Mev is given in the brackets following the symbol: Pt(6.1 ± 0.1), Au(8.1 ± 0.1), Hg(6.6 ± 0.2), Tl(7.3 ± 0.25), Pb(6.9 ± 0.1), Bi(7.2 ± 0.1), Th(6.0 ± 0.15), U(5.8 ± 0.15). The neutrons were detected by the Szilard-Chalmers method of chemical concentration and the γ rays were obtained from a small betatron. Rough values of the total cross sections can be estimated from the results. (auth)

5985 The Photothreshold of ^{208}Pb. R. W. Parsons, D. J. Lees, and C. H. Collie. Proc. Phys. Soc. (London) 63A, 915(1950) Aug. 1 (Letter to the editor).

The threshold for the photodisintegration of $Pb^{208}(\gamma,n)Pb^{207}$ has been measured by the method previously described by Parsons and Collie (NSA 4-5984) and found to be 8.1 ± 0.3 Mev. The measurements were made with the 30-Mev synchrotron at the Atomic Energy Research Establishment, Malvern, which has an aluminium target. The value for the threshold is higher than that (7.37 Mev) recently given by Kinsey, Bartholomew, and Walker (Phys. Rev. 78, 77(1950)). It was possible to confirm that the Pb^{208} threshold was about 1 Mev above that for Pb^{207} and Bi^{209} by direct comparison under the same conditions as were used in the measurement of Soddy's sample of Pb^{208} (Ann. Rep. Chem. Soc. 13, 247,272 (1916)). The difference between the observed threshold and that calculated from Weiszäcker's formula (ΔE_b) of Parsons and Collie is 1.2 Mev, which fits in well with previous results and suggests that the expected discontinuity in the binding energy curve occurs at Bi^{209}.

5986 The Reaction ^{7}Li γp ^{6}He. E. W. Titterton. Atomic Energy Research Establishment. Report AERE-G/M-66, Aug., 1950. 1p.

In the course of experiments to investigate the reaction $Li^7(\gamma,T)He^4$ (Proc. Phys. Soc. (London) 63A, 915(1950)) lithium-loaded nuclear emulsions were exposed to the radiation from the reaction $Li^7(p,\gamma)$ Be^8, Be^{8*}. Definite evidence has been obtained for the reaction $Li^7 + h\nu = H' + He^6 - 10.1$ Mev, the He^6 being formed in the ground state. Nine events have been found. Seven correspond to the 17.6-Mev γ ray and two to the 14.8-Mev γ ray. A cross section for the reaction can be estimated in terms of the $C^{12}(\gamma,3\alpha)$ reaction and the value obtained is $\sigma_{17.6} = (2.0 \pm 0.9) \times 10^{-28}$ cm^2.

5987 Yields of Photo-Neutrons with Calorimetrically Measured 320-Mev Bremsstrahlung. D. W. Kerst and G. A. Price. Phys. Rev. 79, 725-6(1950) Aug. 15 (Letter to the editor).

Samples were placed in a beam of 320-Mev bremsstrahlung and the yield of neutrons per erg of photons was measured by means of a rhodium foil in a large paraffin block. An uncertainty in all results described is due to the unknown variation of efficiency of the detector for the neutron spectra from different elements and from the calibrating source. For the calorimetric determination of x-ray intensity a collimated beam was absorbed in a lead block whose temperature was compared by thermocouples with that of a similar block not in the beam. Observed yields are higher than those predicted by theory. It is noted that, theoretically, 90% of the yield from 320-Mev bremsstrahlung comes from the portion of the spectrum below 22 Mev. Thus the deuteron experiments at 320 Mev and at 22 Mev (Phys. Rev. 77, 806 (1950)) measure the photoeffect primarily in the same energy region.

PHYSICS

5988 Radiation Physics at the National Bureau of Standards. Natl. Bur. Standards (U. S.) Tech. News Bull. 34, 112-15(1950) Aug.

The report announces the installation of a 50-million-volt betatron and plans for a 180-million-volt synchrotron. Fundamental research on the determination of logical standards for free-air ionization measurements with x-ray energies below 15 ~ 20 kv, the collection and evaluation of nuclear data, and the study of the ionization of liquids by radiation is reported. Applied research on the radiation response of photographic emulsions, the study of x-ray protective materials, (glass, etc), and formulation of radiation protective codes and recommendations is mentioned. Work on radiation standards and research apparatus is described.

5989 Matrix Solutions to Steady State Distributions of Particles of Bulk Matter. Wendell C. DeMarcus. NEPA-1448, June 19, 1950. 18p.

The number of photons or neutrons having a collision and entering a particular section of a slab (or shield) divided into many sections and having a particular energy is calculated by setting up a probability matrix for this transition. This matrix is of infinite order to account for the possibility of an infinite number of collisions before entering this space. Theorems are solved relating to this matrix, properties of it are defined and a sample problem is worked out.

5990 Penetration of Gamma Radiation through Thick Targets. W. R. Faust. Naval Research Laboratory. Report NRL-3613, Jan. 18, 1950. 11p.

A study has been made of the modifications in intensity and spectral distribution of a monochromatic beam of gamma rays caused by scattering and absorption in thick shields of lead and aluminum. The intensity is calculated by considering the multiple scattering as taking place in a succession of steps. The spatial distribution is deduced from the equilibrium between quanta in a given group and those added to and removed from this group by scattering and photoelectric absorption. (auth)

5991 Results of 12.4-Mev Proton-Proton Scattering at 90°. F. E. Faris and Byron T. Wright. Phys. Rev. 79, 577-82(1950) Aug. 15.

The differential cross section in the center-of-mass system for 12.4-Mev proton-proton scattering has been determined in the neighborhood of a scattering angle of 90 deg. A photographic technique was used with a camera having cylindrical symmetry. The function f(E) as defined by Bethe (Phys. Rev. 76, 38(1949)) has been calculated from the phase shift and energy for each of the three cross section runs which were made. The average value of f(E) as determined by the experiment agrees closely with the value predicted by a linear extrapolation from the results below 4 Mev. (auth)

5992 The Scattering of Neutrons by Deuterons. S. L. Martin, E. H. S. Burhop, C. B. Alcock, and R. L. F. Boyd. Proc. Phys. Soc. (London) 63A, 884-97(1950) Aug. 1.

The photographic plate method has been used to investigate the angular distribution of deuterons recoiling after neutron impact. The deuteron recoils were produced in a thin target of heavy wax placed in contact with a C2 Ilford nuclear emulsion. For neutrons of energy 2.6–3.1 Mev, produced in the

PHYSICS

D-D reaction, 2000 deuteron recoils were measured. Owing to the short range of the recoils produced when neutrons of low energy are scattered through small angles, the technique is applicable only to the study of the angular distribution in the range 90 to 180 deg in the center-of-mass system. For angles between 120 and 180 deg the results of the present work are in satisfactory agreement with those of previous experimenters using different methods, and they agree with the theoretical form of the distribution calculated by Buckingham and Massey (Proc. Roy. Soc. (London) 179A, 123(1941)) on the assumption of ordinary forces between nucleons. This agreement is not decisive, however, since in this region the calculated distributions for ordinary and exchange forces do not lie far apart. For smaller scattering angles where a decisive test could have been made, the method is too inaccurate. For neutrons of energy from 4.0 to 6.0 Mev and from 6.0 to 9.0 Mev, obtained from a Ra-Be source, the angular distribution over a much larger range of scattering angle has been obtained from the measurement of 1200 deuteron recoils. The angular distribution for neutrons scattered through angles near 180 deg appears to be rather steeper than for slower neutrons, but the ratio of the differential cross section at 90 deg to that at 180 deg is found to be about 0.35 to 0.40, of the same order as for neutrons in the lower energy range. Measurements of 1000 proton recoils from the D-D neutrons showed an angular distribution of neutron scattering angles between 90 and 180 deg that was constant within the limits of the statistical error. (auth)

5993 Radiations from 120-Day Ta^{182}. D. W. Engelkemeir, M. S. Freedman, and Jack May. ANL-4473, June 20, 1950. 16p.

A survey of the literature, combined with the results of an investigation of the hard gammas per disintegration, leads to a complex disintegration scheme for Ta^{182}.

5994 Three New Delayed Alpha Emitters of Low Mass. Luis W. Alvarez. UCRL-739, May 31, 1950. 18p.

Two new positron active isotopes, B^8 and Na^{20}, have been found to decay to excited states of Be^8 and Ne^{20}, which in turn decay "instantaneously" by alpha emission. Their half-lives are 0.65 ± 0.1 sec and 0.25 sec, respectively. N^{12} is also found to have a low energy positron group which leads to an α-unstable excited state in C^{12}. The masses of B^8 and Na^{20} are 8.027 and 20.015, respectively. B^8 decays by a 13.7 ± 0.3-Mev positron, through the same excited state of Be^8 as does Li^8. Estimates of the energies of the excited state in C^{12} and Ne^{20} are made. (auth)

5995 Beta-Gamma-Angular Correlation Experiments. J. R. Beyster and M. L. Wiedenbeck. Phys. Rev. 79, 728-9(1950) Aug. 15 (Letter to the editor).

β-γ angular correlation measurements were made on K^{42}, Na^{24}, I^{131}, Cs^{134}, Co^{60}, Cd^{115}, and Sb^{124} using a scintillation counter coincidence apparatus described previously by the authors (Phys. Rev. 79, 169(1950)) and the correlation function (ratio of the β-γ coincidence rate at 180 deg to that at 90 deg) for each isotope is listed. The correlation function was observed with all energies of β particles entering the counter. The function does not seem to change perceptibly when electrons with less than 600 kev are not counted. The compatibility between the correlation functions and the Gamow-Teller selection rules is discussed.

PHYSICS

5996 Energy Levels Associated with Se^{75}. J. M. Cork, W. C. Rutledge, C. E. Branyan, A. E. Stoddard, and J. M. Le Blanc. Phys. Rev. 79, 889(1950) Sept. 1 (Letter to the editor).

A selenium specimen enriched in mass 74 to 12.1% was irradiated in the Oak Ridge pile. Spectrometric studies of this sample yielded a great number of electron lines whose K-L-M differences are characteristic of arsenic, as expected after positron emission or K-capture in selenium. The energies of the many electron lines observed are shown and interpreted and a summary of the associated 11 γ rays is presented. The half-life of Se^{75} appears to be 128 days. A careful search for the presence of positrons by a magnetic field and counter arrangement disclosed no evidence for their existence. The x-rays to be expected following K-capture in selenium were observed by noting their absorption in aluminum. An energy level scheme for As^{75} which includes all 11 γ-ray transitions is proposed.

5997 Further Investigation of the Radioactivity of Sb^{124}. L. M. Langer, R. D. Moffat, and H. C. Price, Jr. Phys. Rev. 79, 808-12(1950) Sept. 1.

The shape of the highest energy β-ray group in Sb^{124} is found to have a forbidden shape that is characteristic of a once-forbidden transition involving a change of two units of angular momentum and a change of parity. As a consequence, the end points of the three highest energy groups are changed somewhat to 2.291 ± 0.005, 1.69 ± 0.01, and 0.95 ± 0.03 Mev. A high resolution measurement of photoelectrons confirms the existence of the 0.607, 0.653, and 0.730-Mev γ rays. The internal conversion of the 0.607-Mev γ ray was studied. The character of the radiation and relation of the parity assignments to possible predictions of the nuclear shell model are discussed. A search for possible positron or K-capture transitions to Sn^{124} gave no indication of the existence of such radiation. (auth)

5998 A New Long-Lived Krypton Activity. John H. Reynolds. Phys. Rev. 79, 886-7(1950) Sept. 1 (Letter to the editor).

Sodium bromide was subjected to prolonged and intense neutron irradiation and the reaction $Br^{79} + n \rightarrow Br^{80} \rightarrow Kr^{80} + B^-$ took place. The Kr^{80} then captured neutrons to form Kr^{81}. The energy of the γ radiation of the Kr^{81}, as determined from the absorption half-thickness in aluminum, is 12.1 ± 0.4 kev, consistent with the K_α x-rays of bromine. It is concluded that long-lived Kr^{81} decays by K-capture to Br^{81} with a half-life of $2.1 \pm 0.5 \times 10^5$ yr. The neutron absorption cross section of Kr^{80} for the formation of the long-lived nuclide is 12.5 ± 1.5 barns.

5999 On the Evaluation of the Fermi β-Distribution Function. Harvey Hall. Phys. Rev. 79, 745(1950) Aug. 15 (Letter to the editor). (See also NSA 4-4106.)

The author evaluates a function in the Coulomb correction factor involved in Fermi's theory of β-decay by means of an asymptotic formula for the complex gamma-function appearing in the Fermi distribution.

6000 A Precision Determination of the Half-Life of Radium C'. Guy von Dardel. Phys. Rev. 79, 734-5 (1950) Aug. 15 (Letter to the editor).

PHYSICS

The apparatus used in these measurements was a 20-channel time analyzer, originally intended for neutron time-of-flight measurements, and similar in principle to other time-of-flight spectrometers. Six β-ray tubes surround a thin-walled proportional counter, in whose sensitive volume a small thin-walled glass capillary containing radon is mounted. A β-pulse from RaC (Bi^{214}) will be registered by the G-M tubes and is followed by an α-particle from RaC' (Po^{214}) which is registered by the proportional counter. The time-distribution of the α-pulses relative to the β-pulses is analyzed by the time analyzer. The measurements included a number of runs with a total measuring time of about 700 hr. For each run the half-life was calculated according to Peierl's procedure. (Proc. Roy. Soc. (London) 149A, 467(1935)). The final value for the half-life is 163.7 ± 0.2 μsec.

6001 Radiations from Os^{185}, Os^{191}, and Os^{193}. Merle B. Bunker, Robert Canada, and Allan C. G. Mitchell. Phys. Rev. 79, 610-14(1950) Aug. 15.

The radiations from Os^{185} (97 days), Os^{191} (32 hr) and Os^{193} (15 days) have been investigated using a magnetic lens spectrometer. Os^{185} decays by orbital electron capture accompanied by two γ rays of energy 0.648 and 0.878 Mev. The number of γ-ray quanta of 0.648 Mev is six times those of 0.878 Mev. Os^{191} decays by the emission of β rays of maximum energy 1.10 Mev which do not appear to be accompanied by any γ rays. Os^{193} decays by β-particle emission accompanied by two γ rays of energies 0.128 and 0.041 Mev. The β-ray spectrum is obscured by internal conversion and Auger lines, but the end point is approximately 0.135 Mev. (auth)

6002 Radioactive Isomers of Sn^{117} and Sn^{119}. J. W. Mihelich and R. D. Hill. Phys. Rev. 79, 781-3 (1950) Sept. 1.

Four tin samples, enriched in Sn^{116}, Sn^{118}, Sn^{120}, and Sn^{122}, were bombarded in the Oak Ridge pile for a period of one month. The induced 14-day Sn^{117m} activity has been found to consist of a 159-kev transition of multipole order 5 and a 162-kev transition of multipole order 2. An activity of ~250-day half-life has been assigned to Sn^{119m} and a transition of 69 kev, multipole order 5, has been observed. Proposed decay schemes are shown. (auth)

6003 Radioactivity of Scandium^{44}. Joseph A. Bruner and Lawrence M. Langer. Phys. Rev. 79, 606-9(1950) Aug. 15.

Because of the unusual beta-ray spectrum previously reported by Smith, (Phys. Rev. 61, 578(1942)), a study of the Sc^{44} radioactivity has been made. Sc^{44} was prepared according to the reaction $K^{41}(\alpha,n)Sc^{44}$, and the activity was examined in two 180-deg focusing, shaped magnetic field spectrometers. A single positron group (E_0 = 1.463 ± 0.005 Mev; $T_{1/2}$ = 4.0 ± 0.1 hr) was found; the Fermi plot of its momentum distribution has the allowed shape. The positron decay is fed by an isomeric transition (E = 271.3 ± 0.7 kev; $T_{1/2}$ = 57 ± 2 hr) and is followed by a gamma ray (E = 1.16 ± 0.01 Mev) to the ground state of Ca^{44}. No positron transition directly to the ground state was observed. Evidence was found for a high proportion of K-capture to the excited state of Ca^{44}. (auth)

6004 A Short History of Radioactivity. No. XIII. The Actinium and Thorium Series. T. W. Chalmers. Engineer 189, 698-700(1950) June 16.

PHYSICS

Discussions of the actinium disintegration series (about 1905), the U^{235} or actinium series (as it is accepted today), the disintegration of thorium (about 1905), the thorium series in the modern form, and the 4n, 4n + 1, 4n + 2 and 4n + 3 series are presented.

6005 Bremsstrahlung in High Energy Nucleon-Nucleon Collisions. Albert Simon. Phys. Rev. 79, 573-6 (1950) Aug. 15.

Field-theoretic calculations are made of the electromagnetic radiation accompanying a proton-neutron collision. The nucleons are treated nonrelativistically, and it is assumed that their scattering is produced either by a scalar meson field with scalar coupling or a pseudoscalar field with pseudoscalar coupling. The resulting energy spectrum for the photons has the form $(\frac{1}{2}E_0\text{-}ck)^{\frac{1}{2}}\,dk/k$ for the scalar field and $(\frac{1}{2}E_0\text{-}ck)^{\frac{1}{2}}\,kdk$ for the pseudoscalar field. The ratio of the intensity at 90 to 0 deg (in the center-of-mass system) is about 100 for the scalar theory and about 1 for the pseudoscalar case for incident energies of about 200 Mev. Integrated cross sections are obtained for both theories. The yield decreases with energy for the scalar field and increases for the pseudoscalar field. (auth)

6006 High Energy Elastic Scattering of Electrons on Protons. M. N. Rosenbluth. Phys. Rev. 79, 615-9 (1950) Aug. 15.

The theory of the elastic scattering of electrons on protons at very high energies is discussed in detail. A formula is given for the cross section. This formula contains certain parameters which depend on the action of the virtual photon and meson fields. In particular, curves have been calculated on the assumption of scalar and pseudoscalar meson theory. While these perturbation theory calculations are not very trustworthy, and the results depend on the choice of coupling constants, it is thought that qualitative features can be checked with experiment. It is concluded that at low relativistic energies (E < 50 Mev) the experiment provides a valuable check on quantum electrodynamics. At higher energies it should yield data on the nature of the meson cloud of the proton. (auth)

6007 On the Theory of Cherenkov's Effect. M. L. Levin. Zhur. Eksptl. i Teoret. Fiz. 20, 381-3(1950)(in Russian).

In the classical theory of Cherenkov's effect (Tamm and Frank, Doklady Akad. Nauk S.S.S.R. 14, 109(1937); Tamm, J. Phys. (U.S.S.R.) 1, 439(1939)) the vector potential is given in a form that is convenient for the investigation of the field in the wave zone, but cannot be used for the determination of the field in the neighborhood of the electron (since the Hankel function involved approaches infinity). However, the latter problem is closely connected with several practical ones, such as the generation of very short waves, where the focusing of an electron beam for the production of small electron packets requires precisely the knowledge of the field in the region adjoining the electron. With the aid of an expression for a lagging potential, introduced into the classical equation, the author computes the mutual deceleration of two Cherenkov electrons moving in parallel paths, and finds the distance between the two particles below which the deceleration effect is very strong.

PHYSICS

6008 μ-Pair Theories and the π Meson. Gregor Wentzel. Phys. Rev. 79, 710-7(1950) Aug. 15.

The μ-pair theory suggests the interpretation of the π meson as a pair of μ's bound together by a nucleon pair field. Only a nonrelativistic description, involving a cut-off in the momentum spaces, is attempted. Various π-meson types, such as are well known from the conventional Yukawa theories, can be constructed, depending on the type of coupling adopted in the interaction Hamiltonian of the pair theory. It appears, however, that only the pseudoscalar coupling, which leads to a pseudoscalar π meson, is consistent with the experimental data; e.g., on the nuclear scattering of μ's, which indicate that the interaction of μ's with nucleons, at least in such processes, is rather weak. Then, also, the creation of μ-pairs in high energy nuclear collisions is expected to be an infrequent event, compared to the π creation. Nonetheless, the μ-pair production should furnish a crucial experimental test. Another process predicted is the dissociation of a fast π meson, passing through matter, into a pair. The existence of heavier mesons, involving more than two μ's seems likely. 16 references. (auth)

6009 The Phenomenological Theory of Exchange Currents in Nuclei. R. K. Osborn and L. L. Foldy. Phys. Rev. 79, 795-802(1950) Sept. 1.

As was first pointed out by Siegert (Phys. Rev. 52, 787 (1937)) the existence of exchange forces in nuclei implies the existence of accompanying exchange currents. Sachs (Phys. Rev. 74, 433(1948)) has calculated an expression for these, by making the Hamiltonian containing exchange potentials gauge-invariant, and has applied it to the calculations of exchange magnetic moments in H^3 and He^3. The Hamiltonian obtained by Sachs is not the most generally admissible one. More generally, the exchange current density is found to depend on a vector function whose irrotational part is completely determined by gauge-invariance but whose solenoidal part is arbitrary except for the requirements (following from conditions of translational invariance and symmetry in all nucleons on the Hamiltonian) that it be translationally invariant and antisymmetric under the exchange of the spin and space coordinates of each pair of nucleons. Making use of these conditions on the Hamiltonian, the explicit form of the dependence of the solenoidal part of the exchange current upon the spin and isotopic spin coordinates of the nucleons has been derived. In the resultant exchange moments, the irrotational part leads to the expression obtained by Sachs, while the solenoidal term contribution contains the spin operators of the nucleons in particular combinations, together with arbitrary functions of the nucleon separation. Villar's exchange moment expression, as obtained from meson theory, is included as a special case and hence the exchange contributions to the moments of H^3 and He^3 are explicable on a phenomenological basis, contrary to the results obtained in Sachs' special case. The generality and significance of the results are discussed in relation to the various meson theories. (auth)

6010 June Summary Progress Report on Gas Decontamination (24-A-2). Kellex Corporation. KLX-1306, July 10, 1950. 6p.

Sodium chloride suspensions containing Y^{90} tracer have been used to study particle build-up techniques used in gas decontamination. The percentages of aerosol particles found in various size ranges after water-fog injection, steam injection, glycol injection, sonic agglomeration, or any combination of these, is reported. Water-fog and sonic agglomeration, by which 93.6% of the original suspension was built up to above 5 μ, is most promising from an economic viewpoint. A combination of all four methods gave a 97.1% build-up.